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The Practice of Animation Assisted Inquiry Learning Model in Senior High School Chemistry Learning

1st Rabiyatul Adawiyah Siregar
Chemestry Education Department
Institut Pendidikan Tapanuli Selatan
Padangsidimpuan, Indonesia
rabiyatuladawiyah8620@yahoo.co.id

2nd Festiyed
Physical Education Department
Universitas Negeri Padang
Padang, Indonesia

3rd Sufyarma Marsidin
Educational Administration Department
Universitas Negeri Padang
Padang, Indonesia

4th Ellizar
Chemestry Education Depertement
Universitas Negeri Padang
Padang, Indonesia

***Abstract*—This study aims to measure the practice of animation assisted inquiry learning model in Senior High School chemistry learning. The method of this study is Research and Development (R and D). The practical data are gotten by using practical sheets which are filled by the chemistry teachers and the students in the Senior High School. The result of practicing animation inquiry learning model is based on the teachers' responses toward the model book which is 98.88% (very practical), the teachers' book is found 96.85 % (very practical) and based on the students' responses toward the students' book is 96.25% (very practical). Therefore, this study concludes that the practice of animation assisted inquiry learning model is used in Senior High School Chemistry learning.**

Keywords— Practicality, Animation, learning model, inquiry

I. INTRODUCTION

Chemistry is one sciences which studies about special symptoms on the substance and everything relates to the substance such as composition, structure, and characteristics, transformation, dynamics and energetics substance. Chemical material is macroskopic, microscopic and symbolic. In terms of its contents, Chemistry subject involves skills and reasoning. There are two things that relate to chemistry learning process which cannot be separated, for example chemistry as a product and chemistry as a process (scientific work). That is why, chemistry learning process should focus on chemistry characteristics as a process and a product.

One of the aim of this chemistry learning in senior high school is to get experience in applying scientific method by trial or experiment, where the students do hypotheses in doing experiment, doing sampling, processing and interpreting the data, and communicating the experiment result whether oral or written. The results of the research conducted by Eggen and Kauchak (2012) [1] to make students gain experience of scientific method by using guided inquiry learning model with syntax include: presenting questions or problems, making hypotheses, designing experiments, experimenting to obtain information, collecting and analyzing data, conclusion. The syntax used is only suitable for studying macroscopic chemistry with laboratory activities, while the microscopic and symbolic ones cannot be used.

Problems experienced in school, it turns out not all public senior high schools (SMA Negeri) in Padangsidimpuan have adequate laboratory. The results of the author's initial observation, found 50% of public senior

high schools in Padangsidimpuan do not have their own chemical laboratory. The findings of a study by Zengele (2016) [2} and Borneo (2014) [3] show that: 1) the teaching and learning process of science is not adequately supported by science laboratories and in very low categories; 2) The main obstacles encountered in the implementation of activities in the science laboratory include the lack of laboratory space, the material funding for inadequate laboratory science activities, the absence of technicians / assistants / teachers trained in laboratory activities and lack of teacher interest, unavailability of schedule routine in the implementation of laboratory activities, poor management, and the absence of monitoring and evaluation of the implementation of laboratory activities; (3) the activities of science laboratories are not getting attention in some schools; (4) the time allocated for laboratory sessions is still relatively low; (5) as well as the pressure to complete the material

Limitations of laboratory equipment become another problem that often arises because there is still a lot of equipment and chemicals in laboratories that are sent to schools have not been optimally utilized. This is supported by the results of the survey conducted on 6 to 20 April 2015, showing as much as 50.00%, teachers only 1-2 times carrying out chemical practicum activities in one lesson year. For more details are presented in Figure 1.

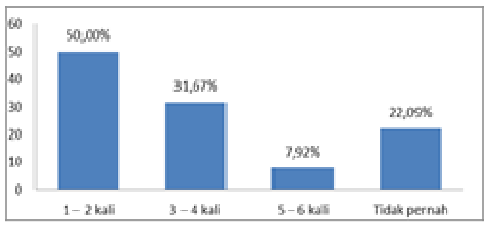

Fig. 1. Implementation of Chemical Practicum in public senior high schools in Padangsidimpuan.

Chemistry teacher in senior high schools in Padangsidimpuan still rarely carry out practicum activities to help students to understand the concept of the material

presented. This is also supported by the results of research conducted by Festiyed (2015) [4] which about 19% of teachers have brought students to the laboratory as much as more than 6 times the semester, while 47% of teachers have not brought students to the lab.

About 4% of the teachers have taken students to the field for practicum more than 6 times for one semester, and only 55% have not brought students to the laboratory. This is also supported by the results of research conducted by Akani (2015) [5] that during this study of chemistry in senior high school still rarely use practicum activities that cause lack of students' scientific attitude, lack of problem solving skills, lack of scientific investigation of students, lack of students' scientific acquisition skills, inadequate chemistry, and poor chemical practices.

The importance of conceptual understanding in the teaching and learning process greatly influences attitudes, decisions and ways of solving problems. Reality in the field students are still less understanding of the concept and less able to use the concept. This is supported by the results of research from Razi (2017) [6] and Bayram (2013) [7] students' skills in laboratory activities are still low, students' thinking ability in finding concepts is still low which causes students' learning achievement is low, students have difficulties in explaining the existing term on chemistry subjects (48.99%), difficulty in understanding the concept of 41.32%, difficulty in solving problems related to calculation of 70.97%. The results of research by Arianto (2015) [8], Sunyono (2009) [9], Pratiwi (2015) [10], Marheni and Sondang (2012) found the cause of the students' concept mistake in answering the chemistry problem is the students did not master the prerequisite concept, the teacher gave less attention to the students, the provision of materials in learning in the classroom students are more directed to memorize information due to time constraints and teaching materials that are not based on the characteristics of students.

Based on interviews and observations at 8 senior high schools in Padangsidimpuan from April to May 2015, students' attitudes still tended to be passive when chemistry learning took place. Students who asked questions during the chemistry learning process were few. When students were divided into groups to solve the problem-solving task, only a few students worked, and were able to solve the teacher's problem. In the end, the student only accepted the explanation from the teacher without trying to discover for himself a chemical concept he was studying. This is in accordance with the results of research conducted Gormally (2009) [11] survey results conducted that students difficulty in conveying ideas and opinions due to lack of sense of confidence, due to students in doing the lab does not do a good cooperation in writing the results of observations and conclusions from the experiments performed.

Guided inquiry is a learning model in which the teacher provides or provides broad guidance to students on this guided inquiry model. The teacher has provided guidance on instructions on the material to be taught to the learners as necessary. The guidance can be a question so that Learners are able to find or seek their own information about the question or the actions of the teacher to be done to solve the problem. This work can be done individually or in groups.

The guided inquiry learning model is an inquiry model that the teacher guides the students to do the activity by giving the initial question and directing to a discussion. The teacher has an active role in determining the problem and stage of the solution. Guided inquiry is used for inexperienced learners with inquiry approach. Thus, students learn more oriented to the guidance and instruction of the teacher until students can understand the concepts of the lesson.

Guided inquiry learning model is one of the appropriate model of learning applied to the classroom conditions that the ability of students varied. Teacher asks many questions on the sidelines of the process, so the conclusions are quicker and easier to take. According to Trianto (2010: 172) [2], Syntax Guided Inquiry is as follows: 1) Presenting questions or problems: Guiding students to identify problems, then written on the board. The teacher divides the students into groups; 2) Making hypotheses: Teachers give students the opportunity to brainstorm in shaping hypotheses. The teacher guides the students in determining the hypothesis that is relevant to the problem and prioritizes which is the priority of the investigation; 3) Designing an experiment: The teacher gives students the opportunity to determine the steps that fit to the hypothesis to be performed. The teacher guides the students to interpret the experimental steps; 4) Conducting an experiment to obtain information: Teachers guide students in obtaining information through experiments; 5) Collecting data and analyzing data: Teachers provide opportunities for each group to deliver the results of collected data processing; 6) Making conclusions: Teachers guide students in making conclusions.

Guided inquiry learning model can improve the ability to understand the concept through observing activities, collecting data, analyzing data, synthesizing data to the conclusion. The syntax used by winnie has its weakness, because at the stage of observing directly goes to the stage of collecting data. To continue until the stage of data collection, students must first formulate the hypothesis.

The formulation of the hypothesis is based on the information they obtain through listening to information from students' books, the internet and watching for example: computer-assisted animation. This hypothesis will have to test its truth by collecting new data, in order to draw conclusions from the formulated hypothesis. Trianto (2010: 69) [12] mentions formulating a hypothesis is a temporary answer to the question or solution of problems that can be tested with data.

Reaction rate materials, Thermochemicals and Chemical Equilibria are materials that require students' ability to draw representations. Chemical equilibrium has an abstract concept of the concepts related to submicrocopic events, so students must understand the chemical equilibrium that represents submicroscopic. Students are confused about the cause of the phenomenon of equilibrium shift. Some students find it difficult to understand the concept of homogeneous and heterogeneous equilibrium, this indicates that students have not been able to understand the concept of abstract chemical equilibrium, while Piaget's theory says at the age of 12-15 years students have been able to think formally is a high intellectual ability in learning the abstract concepts.

One way that can help students to understand the abstract concept of chemistry at submicroscopic level is through instructional media. Increased understanding of students on aspects of submicroskopik and symbolic can be through the animation media. Animation in learning media can represent chemical equilibrium materials at submicrocopic level. Animation in learning media is needed by students in studying chemicals to stimulate imagination and to understand submicroscopic phenomenon.

II. METHODS

The research method used in this research is research and development (R & D). The research instruments developed to collect practicality data were observation sheets that are assessed based on teachers' responses and students' responses. Practicality instruments based on teacher and student responses include: ease of the use of books, time efficiency and benefits.

The feasibility of an assisted inquiry learning model of animation can be seen from the questionnaire that has been filled by teachers and students. Questionnaire is arranged in the form of Likert scale. The calculation of final value data is analyzed by Likert scale on a scale of 0-100 according to Table 1.

TABLE I. CRITERIA OF PRACTICE

No	Value Internal	Interpretation
1.	81-100	Very Practical
2.	61-80	Practical
3.	41-60	Quite Practical
4.	21-40	Less Practical
5.	0-20	Not practical

III. RESULTS AND DISCUSSION

The application of inquiry-assisted inquiry learning model to learning chemistry requires supporting components such as model books, teacher books and student books. Therefore, before applying the instructional model inquiry assisted to animation analysis phase must be done firstly.

Stage analysis is the first step done in this research. This stage is used to obtain information about the basic needs or problems behind the development of inquiry learning model assisted to animation. Stages of analysis in this study include: a) curriculum analysis; b) analysis of student characteristics; c) analysis of learning process.

Based on the results of syllabus analysis from the achievement of learning by looking at the basic competence, the chemicals in class XI odd semester senior high school which has macroscopic, microscopic and symbolic characteristics. In fact, the results of the Lesson Plan Implementation (RPP) designed by teachers have not applied the learning yet that enables students to discover the concepts they are learning. Indicators, objectives, and assessment of learning do not include the three domains (cognitive, psychomotoric and affective). Meanwhile, the learning model used has not led the students in using scientific methods and finding activities. Furthermore, RPP does not have the integration between the competencies, indicators, assessments, materials and learning strategies used in the learning process. The results of this analysis obtained some weaknesses as a basis in designing learning activities by using learning models and other supporting media in order to help students understand and not the occurrence of misconception in chemicals, thus facilitating the understanding of students and making students interested in the material which is being taught.

Analysis of the character of learners can be known by studying the theory of students' characteristics in general and giving questionnaires to students to know the students' interest in chemistry subjects. In theory, senior high school students of class XI are at the age of 16-18 year-old. According to Piaget (Dimyati and Mudjiono, 2009: 14), the student is in the formal operational stage. The formal thinking stage of the student is capable of abstracting an object, reasoning logically and drawing conclusions from the information received. Data on student characteristics in terms of student's interest in chemistry learning, are shown in Table 2.

TABLE II. DESCRIPTION OF CHEMISTRY STUDENT INTEREST IN SMA CLASS XI ACADEMIC YEAR 2016/2017.

No	School Name	Observation Aspect			
		A	*B*	*C*	*D*
1	SMA Negeri 2 Padangsidimpuan	72, 14	68,28	72,71	62,50
2	SMA Negeri 5 Padangsidimpuan	67,05	61,65	62,88	58,81
3	SMA Negeri 7 Padangsidimpuan	66,79	69,53	69,06	68,59
Mean		53,02	66,64	70,24	62,25
Category		Poor	Quite	Good	Quite

Note:
A: Attention
B: Willingness
C: Enjoyment
D: Liveliness

The design is the second step of the ADDIE learning system design model. This step becomes important because it will determine the solution of the problem. Related to this research, the design stage is the answer to the problems that have been found in analysis. At this stage the instructional model is designed to inquiry assisted to animation to improve student learning achievement chemistry. The activities undertaken in this design phase include: (1) advanced studies and establishing theories underlying the content and constructs of animated instructional-assisted learning models, (2) designing the components of the learning model based on Joyce & Weil's (2011) [13]. Elements of this learning model is suitable to use in this study because it is very complete in accordance with the underlying model development to improve student competence in chemistry learning.

This inquiry assisted animation learning model is more dominant referring to the learning model of information processing. Designed and expected model components also

refer to syntax, reaction principles, social systems, support systems and instructional impacts and common companion impacts used in information processing model families (Joyce and Weil, 2011) [13].

The activities undertaken in designing the components of animated aided inquiry learning model include: (1) designing instructional syntax that favored animated inquiry-assisted learning model; (2) designing a social system or learning environment, ie situations or moods and norms of governing activities, interactions, and communication between students and other students, students and teachers during the learning process, (3) designing the principle of reaction, that is giving a picture to the teacher how to treat the student as a learning subject having perception, imagination, attention, and reasoning power and how the teacher's behavior in seeing and responding to every behavior shown by the students during learning, (4) designing a support system, that is the condition or condition required for the learning model being designed to be implemented; (5) designing the impact of learning, both instructional and companion impacts. Instructional impact is the impact that is a direct result of learning, while the impact of the accompanist is an indirect result of learning. The component of the animated assisted inquiry learning model: 1) Syntax (Presenting phenomena/problems, Formulating problems, Stating Hypotheses, Collecting macroscopic data (practice), Observing animation (microscopic material and Symbolic), Communicating, Concluding; 2) Side Efffects (Objective of the research, Confidence, Open minded, Reading ability, Study motivation, Cooperative spirit); 3) Instructional Effects (Cognitive improvement, Psychomotoric improvement, Affective improvement), 4) Supporting System (Animation asssisted in quiry learning model book, Animation assisted inquiry model teacher's book, Animation assisted inquiry model student's book); 5) Reaction Principals (Fasilitator, Supervisor, Motivator, Supervisor); 6) Social System (Supervisor, Fasilitator, Cooperative helping, Responsibility).

In the next stage is development. The researcher undertook the development of an animated aided inquiry model based on a design that has been compiled and revised based on suggestions that have been validated by experts. The revised model was then performed by Focus Group Discussion (FGD). In a limited trial obtained data on the practicality of model books, teacher books and student books. Model book obtained value 95 (appendix 8) with very practical category. More data are presented in Table 3.

TABLE III. RESULTS OF QUESTIONNAIRE PRACTICAL MODEL BOOK

No	Aspects	SMA Negeri 7 Padangsidimpuan	
		Score	*Kategori*
1.	Ease of Use	90	Very Practical
2.	Time efficiency	100	Very Practical
3.	Benefits	100	Very Practical
Total Value		95	Very Practical

The teacher book according to chemistry teacher at SMA Negeri 7 Padangsidimpuan in percentage that is 96,88 (appendix 8) is very practical category. The advice given by the chemistry teacher to solve the answer from the problem that is on the student's book written in the teacher manual. Meanwhile, the level of practicality according to students about the student's book with a percentage of 97.19 (appendix 8) with very practical category. As for the advice given by students in general to add some sample questions and give color to the book to be more interesting. The results of the questionnaire analysis of teacher book practices are presented in Table 4.

TABLE IV. RESULTS OF QUESTIONNAIRE PRACTICAL TEACHER'S BOOK QUESTIONNAIRE ANALYSIS

No	Aspect	Score	Category
1.	Easiness of Using	100	Very Practical
2.	Time efficience	91,67	Very Practical
3.	Benefits	95	Very Practical
4.	Total Value	96,88	Very Practical

The results of the analysis in the table 4 above shows the value of the practicability of Teacher Book product developed into a very practical category used by teachers in the learning process.

Questionnaires are distributed throughout the test class students (XI-IPA 3), it aims to measure whether the student book developed for student learning was practical or not. Questionnaires are filled after students follow inquiry-based learning models, laboratories and computer-assisted simulations. The result of questionnaire analysis of students' book practicality is 97,17 (appendix 8) very practical category. Furthermore, the test data of students' book practicality is presented in Table 5.

TABLE V. TABLE 5. RESULTS OF QUESTIONNAIRE OF PRACTICAL STUDENT BOOK

No	Aspect	Nilai	Kategori
1.	Ease of Use	96,88	Very Practical
2.	Time efficiency	96,59	Very Practical
3.	Benefits	98,18	Very Practical
Total Value		97,17	Very Practical

The product which is developed and tested in limited aims to anticipate errors that may occur during the actual product implementation. The result of the assessment of the inquiry assisted animation instructional model (MIA) based on the teacher's response was obtained by the value of 95 categories are very practical. These data indicate that the components of ease of use, time efficiency and have benefits.

Viewed from the aspect of ease of use has a very practical category, it means the model book easily understood by the teacher, the syntax of learning is easy to do, the social system is visible in the learning process, the support system can improve student learning achievement, instructional impact and accompanist appear because each component has linkage. Thus the animated assisted inquiry learning model can be applied and used by chemistry teachers. This indicates that this model meets the second

criterion of a product that is eligible to use in accordance with Nieveen's opinion in Trianto (2007: 8) [12]. A learning model is good if it is valid, practical and efficient. According to Ilyas (2017) [14] Observation of the inquiry process involves aspects of social system syntax, and the principle of reaction. The results of the research show that these three aspects are easy to use, meaning the syntax, social system, and reaction principle are easy to be implemented in chemistry learning.

Aspects of time efficiency of learning, learning model has a very practical level of practicality. This data shows that the availability of animated instructional inquiry model makes learning time more effective and efficient. This suggests that model books can guide teachers to implement an animated aided inquiry model in accordance with the planned time allocation. The benefits of using the instruction-based model book inquiry with animated categories are very practical. This shows that the model book can help the teacher to teach the materials of Thermochemistry, Reaction Rate and Chemical Equilibrium in class, because the developed learning model has been adapted to the students' learning material and achievement. With the book model can be used to help clarify the procedures of learning activities, relationships and the overall state of what is designed. This is based on the opinion of Joyce and Weil (2011) [13], there are several advantages of the learning model are: 1) clarify the functional relationship between components, elements or elements of a particular system; 2) procedures to be followed in carrying out activities can be identified quickly; 3) with the learning model, the various activities it covers can be controlled; 4) learning model will make it easier for administrators to identify components, elements that are constrained, if activities are implemented ineffective and unproductive; 5) to identify appropriately the ways to make changes if there is a discrepancy of what has been formulated; 6) using the learning model, teachers can arrange student tasks into a unified whole. The inquiry-assisted inquiry model of animation on Thermochemical, Reaction and Chemical Equilibrium materials is practical to be applied in supporting students' chemical learning.

Based on Table 4, it can be concluded that the teacher book as a whole of 96.88 categories is very practical. The stages or syntax of inquiry learning model in animation learning in chemistry learning is easy to implement. The teacher's book has clear instructions for use so that the teacher knows the steps that should be implemented in the lessons that are contained in the lesson plan book. The syntax model developed can make it easier for teachers to stimulate students' curiosity, because the first step of the syntax used is to present the phenomenon or problem. Furthermore, teachers' books can facilitate teachers in guiding students to find concepts.

Judging from the efficiency of time used in accordance with the existing in the syllabus and RPP by using a model of learning developed. The results of Ilyas (2017) [14] study indicate that the time allocation used in accordance with the existing in the syllabus and the activities undertaken using the inquiry model of learning. The teacher book will direct all of its activities in the learning process, as well as the substance of the competencies that should be taught to the students. Student competence will be directed toward the cognitive, psychomotor and affective domains. Furthermore, the teacher book is very useful for teachers in helping the smooth process of learning on chemicals.

The result of questionnaire analysis of students' book practicability shown in Table 54, obtained 97.17 categories is very practical. Questionnaires are distributed throughout the classroom in the trial class, which aims to measure the practicality of a student book developed for student learning. Questionaire on the ease aspect in the use of student books obtained 96.88 categories very practical. The result of the questionnaire shows that the ease of using student's book by using animated instructional inquiry model helps the students to understand the material of Thermochemistry, Reaction Rate and Chemical Equilibrium. Furthermore, students can also find concepts and can make students build their own knowledge because it is accompanied by Student Worksheet (LKPD) in the student book. This result shows that students in using this book can more easily understand the chemistry, so that students are easier in solving various problems related to Thermochemistry, Reaction and Chemical Equilibrium. Results of research conducted by Haloho and Pasaribu (2017) [15]. Student books easy to use because it comes with clear instructions. Furthermore, the results of Syamsu (2017) [16] students' worksheet (LKS) research is easy to use because students are systematically guided based on the instructions for the students, as well as the delivery of materials in accordance with the curriculum and the needs of students. Meanwhile, the results of Nurva's (2016) [17] study on the implementation aspect, students are able to use worksheets of learners (LKPD) based inquiry with enough ease, although there are still questions arising during working on LKPD.

Student books using inquiry-assisted learning model will be directed, because students are encouraged to learn independently and students are actively involved in learning activities. According to Haloho and Pasaribu (2017) [18] Teachers' duties in inquiry learning only guide students in learning activities to achieve learning objectives.

Student books can also direct all of their activities in the learning process, as well as a substance of competence that should be studied / mastered. This is in accordance with the results of research Situmorang (2013) [19] Textbooks can help students to achieve competence according to the demands of the curriculum for guiding students to learn chemistry efficiently so that there is a shift of learning from teacher center learning to student center learning. Similar to Hafiz (2015) [20], the development of textbooks produced can improve learning outcomes for treatment classes that use textbook products.

Practical questionnaires presented in Table 54, from the aspect of time efficiency obtained 96,59 categories are very practical. The result of questionnaires on the efficiency aspects of time used in the use of student books, students are easier to understand the book students with a more effective time and students can learn according to the speed of each learning. According Syamsu (2017) [16] students have a lot of time in doing LKS at school, because students have read and understand the material at home. Therefore, the use of LKS does not require a long time, so more efficient.

Questionnaire of practicality aspects of benefit obtained 98.18 categories very practical. Judging from the result of

questionnaire of benefit aspect, the student book can be used as teaching material that can help the students in finding the problems and concepts learned and help the students in building their own knowledge. These results show that parts of the student book can be used well without any significant obstacles. Nurmita (2017) states that student books that have been tested for practicality can be used in the real learning process. These findings show that the use of an animated aided inquiry model started from the preliminary stage, the core and the cover have a viable syntax for use in the learning process. Judging from the ease of use, the efficiency of time and the benefits of the model books, teacher books and student books are very practical to use in chemistry learning.

IV. CONCLUSION

Based on the result and discussion, it can be concluded that result of appraisal from practitioner to practicality model book obtained 98.88 with very practical criteria. The teacher book obtained 96.85 with very practical category. Student book obtained 96.25 with very practical category. To the UNP lecturers, especially for promoters and advisors have provided a lot of input on the learning model development. Furthermore, it is also useful for the teachers in chemistry subjects who have been willing to use the developed learning model.

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