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Practicality of Guided Inquiry Learning Models Based on Critical Questions (Intersistatic) to Improve Students' Critical Thinking on Temperature and Heat Materials

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Abstract: The guided inquiry learning model is a learning model that is built based on learning concepts and connecting several concepts in the subject. This study aims to determine the practicality of the guided inquiry learning model based on critical questions (intersistatic) to improve critical thinking. This research method uses the Four D development model to define, design, develop, and disseminate. At the dissemination stage, a practicality test was carried out. The instruments used to measure practicality are observation sheets of the implementation of learning and questionnaires on the responses of model teachers and students. The limited testing results from applying the guided inquiry learning model based on critical questions to improve critical thinking have a very good level of practicality. In addition, applying learning models can trigger students' critical thinking skills. Therefore, the guided inquiry learning model based on critical questions can be implemented in learning to improve students' critical thinking.

Keywords: Critical thinking, inquiry, intersistatic, heat, temperature.

INTRODUCTION

One of the abilities needed by a teacher is the teacher's ability to choose learning methods, such as choosing a learning model that is applied in implementing learning. The learning model is a planning pattern to design face-to-face learning in classes and tutorials. In addition, this planning pattern forms learning tools, such as books, films, computers, curricula, etc. Each model directs learning design and helps students achieve learning objectives (Joyce, B., & Weil, 2020). Subjects in junior high school education units that need attention are science lessons. The application of the science learning system should be carried out by professional teachers with learning tools that support learning. According to Susantini (2012), science teachers provide scientific knowledge to students in a simple and precise procedure if they master the material well (Susantini, 2012). In addition, learning tools are needed as guidelines for teachers and students. Science subjects in schools equip students with concepts, ideas, and knowledge about the environment obtained through experience and a series of scientific processes, including preparation, investigation, and creativity (Lestari, 2019). Meanwhile, according to (Yuniarti, 2018), science education can assist students in developing understanding and thinking habits and in mastering life skills, be it observed, scientific attitudes, and predictions.

The 2013 curriculum explains that science learning is carried out in scientific inquiry to foster the ability to think, work and act scientifically and communicate it as an important aspect of life skills. The word inquiry comes from the English “inquiry” and, according to the dictionary, means “question” or “investigation”. The general goal of inquiry learning is to help students develop intellectual thinking skills and other skills, such as asking questions and finding answers that start from their curiosity, based on what was expressed by (Joyce, B., & Weil, 2020) about “The general goal of inquiry training is to help students develop the intellectual discipline and skills necessary to raise questions and seek out answers stemming from their curiosity”. Learning by using this inquiry method, students are mentally and physically involved in solving problems given by the teacher, so students are accustomed to behaving like the attitude of a scientific scientist who is conscientious,

diligent, objective, honest, respects the opinions of others, and creative. The guided inquiry learning model is a learning model that is built based on learning concepts and connecting several concepts in the subject. Educators must be able to present examples of real problems to students and guide students to find patterns in these problems. In addition, educators can also provide reinforcement when students can understand the concepts taught by educators (Hartono, 2013).

Implementation of learning using the guided inquiry learning model by the teacher provides instructions for carrying out investigations by students, based on what was revealed by (Kulthau, 2007) that the principles of using the guided inquiry model must be understood and implemented by a teacher so that the learning process using the guided inquiry learning model guided inquiry can work well. The goal is to get satisfactory results, such as creating fun and oriented learning for students who can think critically and be active in teaching and learning. Implementation of the guided inquiry learning model has several advantages: students can develop language and reading, and social skills, students can build their understanding, students get freedom in conducting investigations, and students can increase learning motivation and develop learning strategies to solve problems. In addition, the use of inquiry learning models also has several weaknesses, such as the learning process requires a longer time, the guided inquiry is highly dependent on students' mathematical abilities, students' language skills, independent learning skills, and self-management, and active students may remain do not understand or recognize basic concepts, rules, and principles. Students often have difficulty making opinions, and hypotheses, making experimental designs, and drawing conclusions (Marzano, 1994).

Recent developments in learning orientation education are directed at developing students' thinking skills. The ability to understand the concepts being taught by students is also expected to have critical thinking skills by asking critical questions. The goal is to increase student activity, interest, motivation, and learning outcomes. Thinking skills are divided into three categories: self-regulated, critical, and creative thinking (Costa, 1985). Then, complex thinking processes are developed into four categories: problem-solving, decision-making, critical, and creative (Ennis, 1996). Critical thinking is the process and ability involved in making rational decisions about what to do and believe. Critical thinking skills can provide good recommendations for taking action because critical thinking is an attitude to assess something (Lamtaruli, et al. 2017). Previous studies have found that applying inquiry learning models can improve students' critical thinking skills (Mustika, 2019) (Parwati, et al. 2020) (Ramadhan, 2021) (Sugiyono, 2009).

Based on what has been described above, it is important to develop a learning model as a learning model that can be applied to improve students' critical thinking skills. Researchers seek to develop new learning models to overcome these problems. The development of learning models by researchers uses the inquiry learning model as a basis and collaborates with critical thinking theory from experts to become a new learning model, namely the guided inquiry learning model based on critical questions (intersistatic) to improve students' critical thinking skills. One development stage was a limited trial to determine the practicality of the learning model being developed. So the purpose of this study was to determine the practicality of the guided inquiry learning model based on critical questions (intersistatic) to improve students' critical thinking skills through limited trials.

METHODS

The research carried out is research and development in the field of education. This research is called development research because it focuses on developing an Interstitial learning model to improve critical thinking in the concept of temperature and heat in science learning. This research method uses the Four D development model: define, design, develop, and disseminate. At the dissemination stage, a practicality test was carried out. The instruments used to measure the practicality of the learning model are observation sheets of the implementation of learning and questionnaires for model teacher and student responses. The implementation of learning is the achievement of the syntax of the learning model that is supported by an appropriate learning environment. Learning activities refer to the syntax of the intersistatic learning model. Assessing the observation of the implementation of the model, each observer gave a value (5: excellent, 4: good, 3: enought, 2: less, and 1: not much).

The activities carried out in the data analysis process of the implementation of learning are as follows (Ramadhan, 2021):

1. Recapitulate the results of observing the implementation of the intersistatic learning model given by three observers using the formula (1).
2. Calculating the average value of implementation using the formula (2).

$$\%\ Implementation = \frac{The\ number\ of\ steps\ taken}{The\ number\ of\ steps\ planned}\ x\ 100\ \% \quad (1)$$

$$\%\ Implementation = \frac{The\ number\ of\ steps\ taken}{The\ number\ of\ steps\ planned}\ x\ 100\ \% \quad (2)$$

The intersistatic learning model is said to meet the practical requirements if it meets the criteria based in Table 1 (Paul, R. and Elder, 2010).

Table 1. Criteria for the level of implementation

No	Persentage Criteria (%)	Category
1	86 – 100	Excellent
2	75 – 85	Good
3	66 – 74	Enough
4	56 – 65	Less
5	0 – 55	Not much

The implementation of the intersistatic learning model is said to be practical if the implementation of learning obtains at least a good criteria. Analysis of teacher and participant response questionnaire data by carrying out the following activities:

1. Convert the answer choices of students and the model teacher in the questionnaire into scores. Giving scores for the teacher's response questionnaire and the student's response questionnaire used the likert scale in Table 2.

Table 2. Scoring based on the likert scale

No	Category	Statement Score	
		Positive	Negative
1	Strongly agree	5	1
2	Agree	4	2
3	Doubtful	3	3
4	Disagree	2	4
5	Strongly disagree	1	5

2. Calculate the average percentage of answers with the formula (3) (Ramadhan, 2021).

$$\%\ Response = \frac{Score\ obtained}{Maximum\ total\ score}\ x\ 100\ \% \quad (3)$$

3. Categorizing the average percentage into the criteria shown in Table 3 (Paul, R. and Elder, 2010).

Table 3. Teacher and Student Response Criteria

No	Persentage Criteria (%)	Category
1	86 – 100	Excellent
2	75 – 85	Good
3	66 – 74	Enough
4	56 – 65	Less
5	0 – 55	Not much

A good response is if the average percentage of each response gets at least a good category.

FINDINGS AND DISCUSSION

1. Implementation of Limited Trial Intersistatis Learning

The results obtained from the observational data on the implementation of the intersistatis learning model on temperature and heat materials in limited trials can be seen in Figure 1.

The teacher's activity that was conveying the learning objectives and carried out a plan to investigate the reasons because when students entered the tables and chairs, they had already formed groups regularly. Hence, the teacher entered and immediately started learning with groups formed from subjects before science lessons. The results of the limited test observations conducted at Muhammadiyah Middle School in class VII type 2 can be seen in Figure 2.

The teacher's activity in the Intersistatic learning model is not carried out, namely conveying the learning objectives. Data from observations of the implementation of limited trial results averaged per class can be seen in Figure 3.

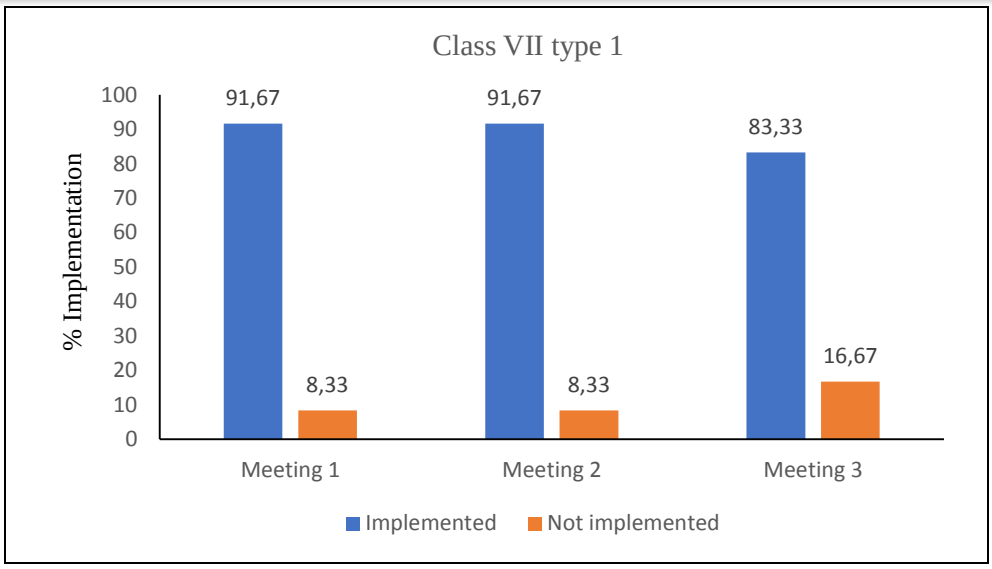

Figure 1. Percentage of completion in limited trial classes in class VII type 1 at SMP Muhammadiyah Batudaa

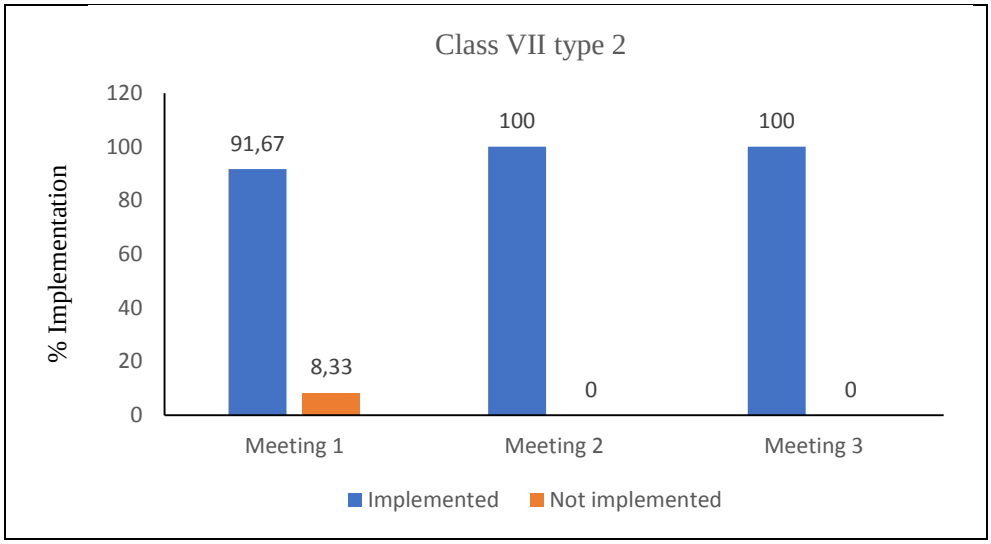

Figure 2. Percentage of completion in limited trial classes in class VII type 2 at SMP Muhammadiyah Batudaa

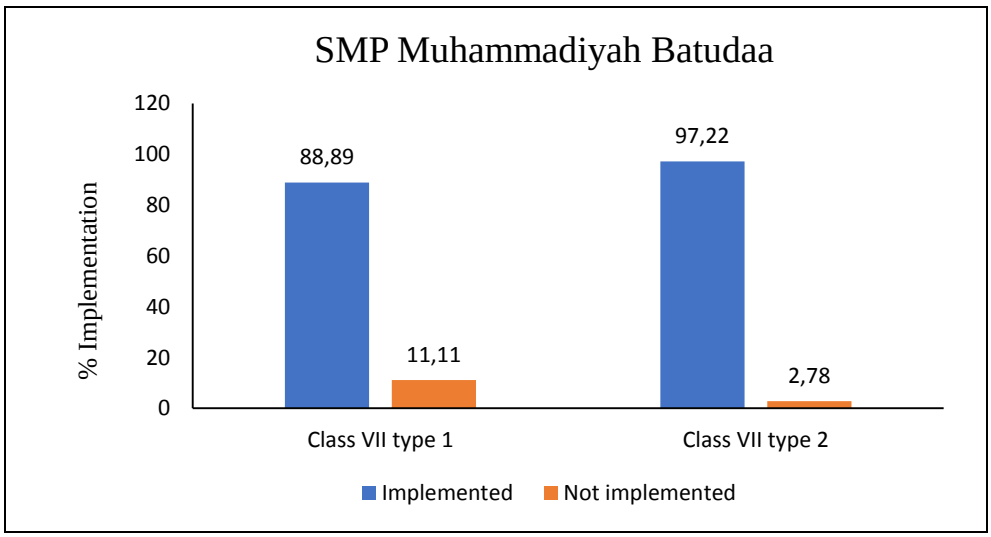

Figure 3. Average percentage of class implementation limited trial at SMP Muhammadiyah Batudaa

Figure 3 displays the average implementation of learning using the intersistatic learning model, which is observed from the teacher's activities. The results were that the average implementation of learning for class VII type 1 was 88.89%, and the average implementation for class VII type 2 was 97.22%. Based on the results of observations of the implementation of learning obtained, the learning model of guided inquiry based on critical questions (intersistatic) is very well implemented in the teaching and learning process in science subjects, especially in the concepts of temperature and heat. In the limited trial class, teacher activities were forgotten, namely conveying learning objectives. This happened because the teacher forgot and assumed that conveying learning objectives to students was unimportant in teaching and learning.

The implementation of the limited trial Interstates learning produced critical thinking trigger questions that were grouped based on indicators of critical thinking trigger questions, according to Paul & Elder, as seen in Table 4-6 (Paul, R. and Elder, 2010).

Table 4. Trigger questions increase critical thinking first encounter limited trial

No.	Syntax of the Intersistatic Learning Model	Trigger Questions Improve Critical Thinking	Critical Thinking Trigger Question Indicator
1.	Presents significant problems with logic	1. Can the doctor know that the patient is sick? 2. Why do doctors only examine the forehead? 3. Does the patient feel sick, so he goes to the doctor?	1. Logical 2. Breadth 3. Logical
2.	Formulate Hypotheses with accurately	4. What is the meaning of temperature? 5. Does feeling cold also mean temperature?	4. Precision 5. Accuracy
3.	Plan the investigation	6. Can the teacher give an example of a problem statement? 7. Can the teacher give an example of a hypothesis?	6. Clarity 7. Clarity
4.	Collect relevant data	8. What do you feel when you put your hand in warm water? 9. What do you feel when you put your hand in plain water? 10. What did you feel when you put your hand in ice water? 11. How does he know the temperature by hand? 12. Why doesn't he use a thermometer? 13. What are the benefits of putting your hand between plain, warm, and ice water?	8. Logical 9. Logical 10. Logical 11. Relevance 12. Breadth 13. Significance
5	Process/analyze data in depth and more broadly	14. How to use a thermometer? 15. Who invented the thermometer first? 16. Why can a thermometer be used to measure temperature? 17. What are the materials of the thermometer?	14. Accuracy 15. Breadth 16. Clarity 17. Depth
6.	Make clear and precise conclusions	18. What is the temperature of the human body when it is sick?	18. Accuracy

Based on Table 4, it can be seen that there are 18 critical thinking trigger questions obtained from the interstatistic learning in the limited trial of the first meeting. The highest number of questions from students is in the syntax of collecting relevant data, namely six questions, while the least number of questions is in the syntax of making appropriate conclusions, namely 1 question. The number of questions in the syntax of collecting relevant data is more than the others because, at this stage, students are asked to write questions on student worksheets based on observations of learning videos. In contrast, students make clear and precise conclusions at the syntax stage with only 1 question. This proves that students already understand the conclusions and explanations of the teacher regarding the learning material.

Judging from the quality of the questions that arise based on standard question indicators that trigger critical thinking Paul & Elder, there are 5 Logic indicator questions, two breadth indicator questions, three accuracy indicator questions, three clarity indicator questions, and 1 question each on the accuracy, relevance, depth indicators, and significance.

Table 5. Trigger questions increase critical thinking second meeting limited trial

No.	Syntax of the Intersistatic Learning Model	Trigger Questions Improve Critical Thinking	Critical Thinking Trigger Question Indicator
1.	Presents significant problems with logic	1. What causes the boiled water to decrease after boiling? 2. Why is it that water drips from the pot cover when you open the lid? 3. Why is the skin damaged when exposed to hot water?	1. Accuracy 2. Breadth 3. Clarity
2.	Formulate Hypotheses accurately	4. What is heat? 5. What is expansion?	4. Precision 5. Precision
3.	Plan the investigation	6. Can the teacher explain the picture for the formulation of the problem?	6. Clarity
4.	Collect relevant data	7. Why do iron, glass, and copper expand? 8. Can copper and glass expand? 9. What tools were used in the experiment? 10. Why does the iron get hot when it is burned? 11. What is the purpose of experimenting? 12. Can iron expand if it replaces its heater with a candle flame? 13. What are the steps of the experiment? 14. What causes expansion? 15. Is there a difference in the expansion between iron, copper and glass? 16. What effect does the heating engine have on expansion?	7. Accuracy 8. Depth 9. Clarity 10. Precision 11. Logical 12. Breadth 13. Relevance 14. Depth 15. Accuracy 16. Relevance
5	Process/analyze data in depth and more broadly	17. Can friends explain the difference between heat and temperature? 18. What are the factors that cause expansion? 19. Can you explain examples of expansion in everyday life?	17. Accuracy 18. Depth 19. Clarity
6.	Make clear and precise conclusions	20. Can wood expand? 21. Does plastic expand?	20. Logical 21. Logical

Table 5 shows 21 critical thinking trigger questions were obtained from the intersistatic learning in the second meeting limited trial. The highest number of questions from students is in the syntax of collecting relevant data, namely ten questions, while the least is in planning a clear investigation, namely 1 question. The number of questions in the syntax of collecting relevant data is more than the others because, at this stage, students are asked to write questions on student worksheets based on observations of learning videos, while at the syntax stage, clearly planning investigations students only give 1 question. This is because, at this stage, the students are guided to form groups and understand the steps or parts of the student worksheets.

Judging from the quality of the questions that appear based on the standard question indicators that trigger critical thinking, Paul & Elder, there are four accuracy indicator questions, two breadth indicator questions, four clarity indicator questions, three accuracy indicator questions, three depth indicator questions, three logic indicator questions, two indicators relevance, and there is no question of significance indicators.

Based on Table 6, it can be seen that there are 17 critical thinking trigger questions obtained from the intersistatic learning in the third meeting limited trial. The highest number of questions from students is in the syntax of collecting relevant data, namely eight questions, while the least number of questions is in the syntax of planning a clear investigation and the syntax of making clear and precise conclusions, namely only 1 question each. The number of questions in the syntax of collecting relevant data is more than the others because, at this stage, students are asked to write questions on student worksheets based on observations of learning videos, while at the syntax stage, clearly planning investigations students only give 1

question. This is because, at this stage, the students are guided to form groups and understand the steps or parts of the student worksheets. The syntax for making precise and clear conclusions also only obtained 1 question. This was because students were able to understand heat transfer material.

Table 6. Trigger Questions Increase Critical Thinking Third Meeting Limited Trial

No.	Syntax of the Intersistatic Learning Model	Trigger Questions Improve Critical Thinking	Critical Thinking Trigger Question Indicator
1.	Presents significant problems with logic	1. How can a cauldron handle be hot when only the bottom of the cauldron is touching the flames? 2. Can the teacher give another example?	1. Relevance 2. Breadth
2.	Formulate Hypotheses accurately	3. What is meant by heat capacity? 4. What is meant by heat transfer? 5. How to achieve the learning objectives?	3. Precision 4. Precision 5. Relevance
3.	Plan the investigation	6. What observation will we make?	6. Clarity
4.	Collect relevant data	7. What happened to the crossbar that was burned? 8. What is the temperature of boiling water? 9. Does the ruler get hot due to heat transfer? 10. Why does water boil? 11. What is the volume of boiling water? 12. Why is the bonfire hot? 13. How do we feel when we are near a campfire? 14. Why can heat move around?	7. Logical 8. Accuracy 9. Logical 10. Logical 11. Accuracy 12. Clarity 13. Logical 14. Depth
5	Process/analyze data in depth and more broadly	15. Name and explain the various types of heat transfer? 16. What happens if we get too close to a bonfire?	15. Clarity 16. Clarity
6.	Make clear and precise conclusions	17. Can the teacher give a more detailed conclusion?	17. Precision

Judging from the quality of the questions that appear based on standard question indicators that trigger critical thinking Paul & Elder, there are two relevance indicator questions, three accuracy indicator questions, four clarity indicator questions, three accuracy indicator questions, two accuracy indicator questions, four logic indicator questions, one indicator question depth, and there is no question of significance indicators.

The total number of questions that trigger increased critical thinking for each syntax in the limited trial can be seen in Table 7.

Table 7. Number of critical thinking trigger questions every syntax on limited trial

No.	Intersistatic Syntax	Meeting			Number
		1	2	3	
1.	Presents significant problems with logic	3	3	2	8
2.	Formulate hypotheses accurately	2	2	3	7
3.	Plan the investigation	2	1	1	4
4.	Collect relevant data	6	10	8	24
5.	Process/analyze data in depth and more broadly	4	3	2	9
6.	Make clear and precise conclusions	1	2	1	4
	Total				56

Table 7 displays the highest number of critical questions obtained in the syntax of collecting relevant data, namely 24 questions because of syntax's learning stage to collect relevant data. Participants were asked to write questions according to the pictures provided in the student worksheets. The number of questions on planning an investigation is clearly the same as the number of questions on making a clear and precise conclusion, namely four questions. This number is the lowest compared to the learning stages in other syntaxes because at

the syntax stage. Students are planning investigations doing group division activities, and learning resources to ask questions only related to parts unclear on the student worksheets or steps that have not been understood on student worksheets. The syntax of giving clear and precise conclusions is also the stage that gets the lowest questions compared to other syntaxes because, at this stage, students can understand the conclusions that have been conveyed and explained.

Overall the number of questions based on indicators of increasing critical thinking in the limited trial class can be seen in Table 8.

Table 8. Number of questions for each question indicator critical thinking triggers in limited experiments

No.	Critical Thinking Trigger Question Indicator	Meeting			Number
		1	2	3	
1.	Clarity	3	5	4	12
2.	Accuracy	3	4	2	9
3.	Precision	1	3	3	7
4.	Relevance	1	2	2	5
5.	Depth	1	3	1	5
6.	Breadth	2	2	1	5
7.	Logical	5	3	4	12
8.	Significance	1	0	0	1
	Total				56

Table 8 shows that the highest number of questions are found in the Logic indicator, namely 12 questions, while very few are found in the significance indicator, namely 1 question.

2. Data on Student Responses to the Limited Trial Intersistatic Learning Model

Students' responses to learning with the intersistatic learning model on the concepts of temperature and heat are carried out in junior high schools, namely SMP Muhammadiyah Batudaa, which consists of two classes. Students were asked to fill out a student response questionnaire after being given treatment, namely applying the intersistatic learning model in three meetings. The data obtained from students' responses in the limited trial class can be seen in Figure 4.

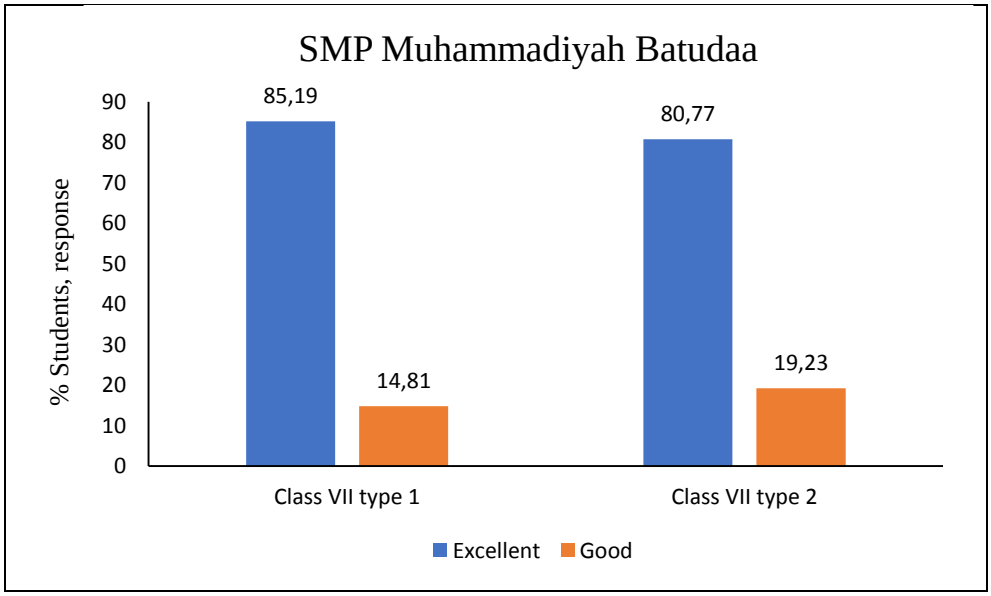

Figure 4. Percentage of student responses in class limited trial of SMP Muhammadiyah Batudaa

Based on Figure 4, the student's responses to learning by applying the intersistatic inquiry learning model in class VII 1 obtained 85.19% very good responses and 14.81% good responses. Meanwhile, for class VII 2, the data obtained was 80.77% giving a very good response and 19.23% giving a good response. Figure 4 states that no students gave a less or not much response to the application of the intersistatic learning model,

so the intersistatic learning model can be said to be practical.

The analysis of student response questionnaires found that students felt happy learning science using the intersistatic learning model, so students became more enthusiastic about learning. Students are more active and motivated to think in conveying critical questions in the learning process.

The practicality of the intersistatic learning model in the limited trial class was tested using the implementation observation instrument and student response questionnaires. The practicality of the intersistatic learning model in implementation for a limited trial class was carried out at SMP Muhammadiyah Batudaa in as many as two classes. In contrast, the extended tryout was carried out at SMP Negeri 1 Batudaa and SMP Negeri 2 Batudaa.

On average, the implementation of learning in the limited trials of class VII 1 and VII 2 was very good, reaching 88.89% and 97.22%. In more detail, implementation in class VII 1 for the first and second meetings was the same; namely, 91.67% was implemented, and 8.33% was not implemented. In the implementation observation sheet used, there are 12 teacher activities. So that 91.67% means that in the first and second meetings, there are 11 teacher activities in the intersistatic learning model that are carried out, and 8.33% means that in the first and second meetings, there is one teacher activity that is not carried out in the learning process, namely conveying learning objectives. This process was not carried out due to the early learning using the intersistatic learning model, which was still relatively new. The teacher admitted that he was still rigid and negligent in delivering learning objectives.

In the third meeting, 83.33% of teacher activities were carried out, and 16.67% of data were not carried out. In the observation sheet used, 83.33% means that 10 out of 12 teacher activities were carried out, while 16.67% were not carried out, meaning that two teacher activities were not carried out. The teacher's activity that was not carried out was conveying the learning objectives and carrying out a plan to investigate the reasons because when entering learning, the tables and chairs of the students had already formed groups regularly. Hence, the teacher entered immediately to start learning with groups formed from subjects before science lessons.

The results were that the average implementation of learning in the extended trials for class VII 1 and VII 2 and class VII 3 at SMPN 1 Batudaa received very good quality, namely 100% implementation. In the implementation observation sheet used, there are 12 teacher activities, 100% means that it is carried out as a whole in every meeting. The same results were also obtained from observing the implementation of learning at SMPN 2 Batudaa where the results reached 100%. This can also be interpreted that the 12 teacher activities in the observation sheet of the implementation of learning are all carried out well. This finding is consistent with research conducted by (Lamtaruli, et al. 2017), who obtained the results of implementing the guided inquiry syntax in the very good category. The good implementation of the inquiry learning model influences increasing students' critical thinking skills.

Students' responses to learning using the intersistatic learning model in limited trials were analyzed according to the criteria put forward by (Paul, R. and Elder, 2010). The results of the analysis of the responses of students at SMP Muhammadiyah grades VII 1, and VII 2 gave very good responses and good responses. The analysis of student responses in the limited trial did not find students who gave poor or very unfavorable responses.

Student responses to the extended trial were also analyzed based on the criteria suggested by (Sugiyono, 2009). The results of the analysis of student responses in the expanded trial obtained very good criteria, and good criteria were not found in students who gave poor or very poor responses. Based on these results, it can be said that the student's responses consisting of 35 statement items gave good results according to the students. The statements in the student response questionnaire indicate that after going through the learning process with the intersistatic learning model, students feel more concentrated, enthusiastic, active, and serious in learning temperature and heat. In addition, referring to other statements in the student response questionnaire, it can also be interpreted that students feel very happy, don't feel bored, and enjoy learning with student worksheets because they can work together while sharing knowledge with group mates through analysis, observation, and making questions, discussion, and problem-solving. This causes students to look more active and motivated to think in conveying critical

questions in the learning process. This is in line with the results of research conducted by (Hariani, et al. 2020), who received a positive response to applying the guided inquiry learning model in the good and very good categories. Furthermore, (Irawanto, et al. 2019) stated in his research results that applying the inquiry learning model obtained responses in the very good category. Based on the analysis of implementation data and student response questionnaires which showed good results, it can be said that using the intersistatic learning model in the limited trial class is said to meet the model's practicality criteria.

CONCLUSION

Based on the results of limited testing from applying the guided inquiry learning model based on critical questions (intersistatic) to improve critical thinking, it has a practical level in the good category. This learning model can be applied by teachers in implementing science learning in the classroom. Applying the guided inquiry learning model based on critical questions can trigger critical thinking skills, which are indicated by students' emergence of critical questions.

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REFERENCES

Costa, A. (1985). Goals for a Critical Thinking Curriculum. Developing Mind: A Resource Book for Teaching Thinking. *ASCD: Alexandria, Virginia*.

Ennis (1996). Critical Thinking. *New Jersey: Prentice Hall, Uper Saddle River*.

Hariani, N. R., Nuwowatia, M. & W. (2020). Pengaruh Penerapan Model Inkuiri Terbimbing Berbantuan E-Modul Terhadap Pemahaman Konsep Inkuiri Garam. *Jurnal Inovasi Pendidikan Kimia*, *14*.

Hartono (2013). Ragam Model BelajarMengajar Yang Mudah Diterima Murid. *Jogjakarta: Diva Press*.

Irawanto, T. & Sulanjari, S. (2019). Pengaruh Penerapan Model Pembelajaran Guided Inquiry Pada Pembelajaran Kompetensi Menerapkan Pencucian Dan Penyimpanan Di Kelas X Jasa Boga SMKN 2 Jombang. *E-Jurnal Tata Boga*, *8*, 307 – 315.

Joyce, B., & Weil, M. (2020). Models of Teaching. *Boston: Allyn; Bacon*.

Kulthau, T. (2007). Guided Inquiry: A Framework for Learning Through School librariesin 21st century school. *New Jersey: CISSL*.

Lamtaruli. Hariyanto. & Sanova, A. (2017). Analisis Keterlaksanaan Model Pembelajaran Inkuiri Terbimbing dan Pengaruhnya Terhadap Kemampuan Berpikir Kritis Siswa Pada Materi Larutan Penyangga Kelas XI IPA SMAN 11 Kota Jambi. *Universitas Jambi*.

Lestari, T. (2019). Pengembangan Rencana Pelaksanaan Pembelajaran Mata Pelajaran Akutansi Dasar Berorientasi Peraturan Dirjen Dikdasmen Kemendikbud No. 07/D. D5/Kk/2019. *Seminar Nasional Keindonesiaan*.

Marzano, R. J. (1994). Assessing Student Outcomes: Performance Assessment Using the Dimensions of Learning Model. *Pittsburgh: ASCD*.

Mustika, R. W. (2019). Peningkatan Hasil Belajar IPA dan Berpikir Kritis Peserta didik Melalui Penerapan Pendekatan Kontekstual Model Inkuiri. *Journal of Education Action Research*, *3*, 117–123.

Parwati, G. A. P. U., Rapi, N. K. & Rachmawati, D. O. (2020). Penerapan Model Pembelajaran Inkuiri Terbimbing Untuk Meningkatkan Kemampuan Berpikir Kritis Dan Sikap Ilmiah Siswa SMA. *Jurnal Pendidikan Fisika Undiksha*, *10*, 49–60.

Paul, R. & Elder, L. (2010). The Miniature Guide to Critical Thinking Concepts and Tools. *Dillon Beach: Foundation for Critical Thinking Press*.

Ramadhan, F. A. (2021). Penggunaan Strategi Pembelajaran Inkuiri Terbimbing

Dalam Pembelajaran IPA di Pendidikan SD. *Vektor: Jurnal Pendidikan*, *2*.

Sugiyono (2009). Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R&D. *Bandung: Alfabeta*.

Susantini, E. (2012). Pengembangan Petunjuk Praktikum Genetika untuk Melatih Keterampilan Berpikir kritis. *Jurnal Pendidikan Fisika Indonesia*, *2*.

Yuniarti, S. (2018). Peningkatan Hasil Belajar Dengan Menggunakan Media Video Dalam Pembelajaran IPA di Sekolah Dasar. *Jurnal Pendidikan Dan Pembelajaran UNTAN*, *4*.