International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 07 Issue 06 June 2024
DOI: 10.47191/ijcsrr/V7-i6-39, Impact Factor: 7.943
IJCSRR @ 2024
www.ijcsrr.org

# Meta-Analysis the Effectiveness of Implementing the Argument Driven Inquiry (ADI) Model in Improving Students' Critical Thinking

**Yolanda Eka Putri[1], Neni Hasnunidah[2], Undang Rosidin[3]**
[1] Student of Master of Science Education, University of Lampung, Indonesia
[2,3] Lecturer of Science Education, University of Lampung, Indonesia

**ABSTRACT:** In preparing the order of life in the era of revolution 4.0, it is necessary to prepare competencies in achieving national education goals. The competency needed in the 21st century is the ability to think at a high level. These skills are critical thinking, creative, collaborative and communicative. This meta-analysis study aims to analyze the effect of using the *Argument Driven Inquiry (ADI)*model towards increasing students' critical thinking skills in learning. The method used in this research is a meta-analysis method by reviewing 9 journal articles and integrating 1 international journal article and 8 national journal articles. Data analysis was carried out by calculating the average *Effect Size* (ES) which is then categorized based on interpretation of Cohen's criteria. Based on the study results, the average ES model in the effect of applying the ADI model on students' critical thinking skills is 0.36 in the medium category. So, it can be concluded that the ADI model can have a positive effect on students' critical thinking skills.

**KEYWORDS:** Argumentation, Argument Driven Inquiry (ADI), Critical Thinking Skills, Effect Size, Meta-Analysis.

## INTRODUCTION

The development of knowledge and workspace demands must be followed by the development of future students' abilities and skills. One effort that can be made to be ready to face the new order of life in the era of industrial revolution 4.0 is to encourage changes in the field of education. Based on data from the Program for International Student Assessment (PISA), the ability scores of Indonesian students, especially in the fields of mathematics, science and literacy, are below average. For this reason, there is a need for competency preparation in achieving national education goals. According to the OECD (2008) identified the competencies needed in the 21st century, namely "The 4Cs" - communication, collaboration, critical thinking, and creativity". These four competencies are considered important to be taught to students in the context of core fields of study. The skills that students need to master are creativity, critical thinking, problem solving, communication and collaboration [1]. These skills direct students to solve problems that may exist in the future. One way to improve science learning, especially in the sciencefield, is to train students' critical thinking skills. It should be emphasized that critical thinking is a necessary skill for students to besensitive to sustainability issues. This ability is a skill that students must master in the 21st century. Critical thinking means reasoning effectively, recognizing relationships between systems, concepts and scientific to solve problems [2].

Critical thinking skills are really needed in solving problems in science learning. Science learning also requires students to have high analytical and evaluation skills in solving every problem [3]. So, in the science learning process, students really need critical thinking skills. Critical thinking skills have the potential to form quality people, because this skill plays a very important role in helping someone to solve problems [4]. Apart from that, the ability to think critically is an ability that is very necessary for a person to be able to face various problems faced in social and personal life [5]. Critical thinking skills have the potential to improve human quality, because these skills are very important in helping students to solve problems [6]. Therefore, efforts to train critical thinking skills in the educational process are important [7].

Apart from that, critical thinking skills also have a relationship with argumentation skills. Indicators of critical thinking are: (1) able to understand and formulate the main problem, (2) able to express reasons based on facts/evidence, (3) able to make/choose arguments that are logical, relevant and accurate, (4) able to explain the meaning of the argument which are made based on different points of view and (5) are able to determine the consequences of an argument taken as a decision [8]. One of the sub-aspects is being able to make/choose logical arguments. There are several indicators of critical thinking, one of which is that students are declared capable of critical thinking if they are able to analyze, understand and evaluate argumentative statementsin learning [9].

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Students' critical thinking abilities are realized through how to communicate and express the material they understand [10]. So, it can be said that if someone has good critical thinking skills, they will also have good argumentation skills [11]. Critical thinking is seen as a metacognitive process consisting of several sub-skills such as memory, comprehension, analysis, evaluation, inference, and reflective judgment. Individual argumentation and problem solving abilities can be improved when critical thinking is used appropriately [12]. This is because one of the elements of critical thinking is recognizing arguments. Therefore, practicing argumentation has been proven to improve students' critical thinking abilities [13].

However, in the learning process, in fact, there are still many students who do not yet think critically in solving a problem and managing the information obtained so that it can be analyzed well. Students are only able to recognize or identify explanations of simple scientific phenomena but are not able to use various information, explain evidence and arguments using critical analysis, and are not able to demonstrate the ability to think and reason scientifically [3]. Based on this explanation, critical thinking skills need to be empowered or stimulated. This habituation or stimulus cannot be done in a conventional learningatmosphere, strategy and model [14].

One model that can be used to train critical thinking and argumentation skills at the same time is the Argument Driven Inquiry (ADI) model. ADI is a model that emphasizes student-centered learning. This provides students with more opportunitiesto construct knowledge and scientific explanations through self-inquiry [15]. One solution that can be done to improve students' critical thinking skills is to apply learning with the Argument-Driven Inquiry (ADI) model [16]. The ADI learning model is a learning model designed to provide effective learning experiences in the classroom and more authentic experiences in science laboratory learning, especially in improving students' critical thinking skills. The Society of College Science Teachers (SCST) has recommended that laboratory practices be redesigned so that the activities are more inquiry-based, grounded in current research on how people learn, and promote more critical thinking, problem solving, and collaborative work on meaningful tasks [17].

It is hoped that with this ADI model students will not only receive concepts and knowledge passively but rather students will be able to actively investigate or discover knowledge by solving problems that arise [18]. The ADI model provides a way for students to develop the knowledge and skills they need to become experts in science while in school [19].

According to Kadayifci, Atasoy, and Akkus in their research also stated that through the ADI model in learning can improve students' argumentation skills, apart from that, a close relationship was found between students' weaknesses in arguing with their critical and creative thinking skills, where students who were able think critically in solving problems, then argumentation skills also increase [20]. The ADI model differs from other methods in being able to give students the opportunity to design research and find their own results, as well as to engage in an argumentation process where they can share and support their ideas. This method consists of peer review which improves students' critical thinking skills, thereby giving students the opportunity to see andcorrect their shortcomings [21].

In the ADI learning model, students will be invited to identify tasks, collect data and produce their own arguments, which will be felt to be able to grow and improve critical thinking skills [22]. Apart from that, the ADI model also requires students to peer-review lab reports which develops students' critical thinking skills [21]. This step learning model is designed to provide students with educative feedback, encourage students to develop and use appropriate standards, and to help students become more metacognitive as they work. It is also designed to create a community of learners that values evidence and critical thinking in the classroom [22]. A number of studies show that such activities can help students learn content, develop complex reasoning and critical thinking skills [23]. This shows that the syntax contained in the ADI model can train students' critical thinking skills, especially in science subjects.

## METHOD

This review aims to describe the effectiveness of implementing the learning model in improving students' critical thinking skills. The method used in this research is a literature review. Literature review is a systematic method for identifying, evaluating and synthesizing research works and thoughts that have been produced by previous researchers [24]. This method is used to find answers to research questions using various literature [25]. The literature used comes from national and international journals by reviewing 9 articles that use the learning model Argument Driven Inquiry (ADI) on students' critical thinking skills. Meta-analysis is quantitative because it uses the calculation of numbers and statistics for practical purposes, namely to compile and extract information from so much data that is not possible with other methods of meta-analysis [27]. In this section we will explain in detail

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details of literature search methods and selection criteria, coding process, and meta-analysis procedures.

**Literature search and selection criteria**. This data is a development of one of the designs for a systematic review of research results in the form of a meta-analysis that explores the impact and variations of learning interventions in various scientific disciplines [27]. The selection of this meta-analysis sample is focused on the impact of the effectiveness of using the Argument Driven Inquiry (ADI) model on students' critical thinking skills. Then these keywords are linked to learning outcome keywords such as: critical thinking skills, high order thinking skills, and science process skills. In this case, 9 articles were selected, both studies originating from local (8 articles) and international research (1 article) which became the study samples in the meta analysis.

**Coding process (Coding Process)** based on the meta-analysis research design, the coding process in this study includes the treatment or process in learning Argument Driver Inquiry as described as follows:

**Table 1. Syntax of Argument Driven Inquiry**

| Argument Driven Inquiry | Description |
|---|---|
| Inquiry (SI) syntax (procedure) | problem identification,<br>data collection,<br>making tentative arguments,<br>argumentation session,<br>preparation of a written investigation report,<br>review of reports,<br>revision based on the results of the review,<br>reflective discussion. |

Effect size (ES) is a measure of the practical significance of research results in the form of a measure of the magnitude of the correlation or difference, or the effect of one variable on another variable. This measure complements the analysis results information provided by significance tests. The following is the formula for finding the effect size according to Cohen.

**Table 2. Effect size categories**

| Cohen's Standard | Effect Size |
|---|---|
| Height | 0,6-2,0 |
| Currently | 0,3-0,5 |
| Low | 0,0-0,2 |

## RESULTS AND DISCUSSION

Analysis results from 9 Learning Program journal articles Science Based Argument Driven Inquiry Regarding students' critical thinking skills, it can be seen in Table 3. The discussion in this research includes the overall average influence of the effectiveness of using the model. Argument Driven Inquiry on students' critical thinking skills, then they will be compared based on country, level of education and field of study.

**Table 3. List of Studies, Coding, and Effect Sizes**

| No | Researcher | Country | l of study/Level | Research | N | IS | Is |
|---|---|---|---|---|---|---|---|
| 1 | [3] | Indonesia | Science/Middle School | Critical thinking | 53 | 0,26 | R |
| 2 | [28] | Indonesia | Science/ Middle School | Critical thinking | 31 | 0.38 | S |
| 3 | [1] | Indonesia | Science/ MiddleSchool | Critical thinking | 204 | 0,44 | R |
| 4 | [11] | Indonesia | Science/Middle School | Critical thinking | 50 | 0,32 | R |

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5 | [4] | Indonesia | Science/ Middle School | Critical thinking | 315 | 0.52 | S |
| 6 | [22] | Indonesia | Science/ MiddleSchool | Critical thinking | 30 | 0,41 | S |
| 7 | [16] | Indonesia | Science/ Middle School | Critical thinking | 52 | 0,64 | T |
| 8 | [20] | Türkiye | Chemistry/Student | Critical thinking | 30 | 0,43 | R |
| 9 | [8] | Indonesia | Science/ High School | Critical thinking | 64 | 0,57 | R |
| 10 | [21] | Türkiye | Biology/Primary School | Argument-based Inquiry | 79 | 0,46 | S |
| 11 | [23] | America | Science/Middle School | Argument-basedInquiry | 15 | 1,05 | T |
| 12 | [28] | Türkiye | High School/Physics | Argument-based Inquiry | 63 | 2,00 | T |
| 13 | [17] | America | Chemistry/Student | ADI instructionalmodel | 32 | 0,43 | S |
| 14 | [28] | America | Chemistry/Student | Argument-based Inquiry | 186 | 1,98 | T |
| 15 | [28] | America | Chemistry/Student | Argument-basedInquiry | 39 | 0,69 | T |
| 16 | [19] | America | Science/Middle School | Argument-basedInquiry | 38 | 0,51 | S |
| 17 | [29] | Türkiye | Chemistry/Student | the effectiveness of Argument-DrivenInquiry | 125 | 0,25 | R |
| 18 | [15] | Thailand | Chemistry/High School | Skills in using the ADI model | 31 | 0,40 | S |
| 19 | [2] | Indonesia | Science/Middle School | ADI & CriticalThinking | 28 | 0,32 | S |
| 20 | [13] | Indonesia | Physics/High School | Development of students' argumentationprocesses | 32 | 0,48 | S |
| 21 | [6] | Indonesia | Chemistry/Teacher | ADI & Critical Thinking | 20 | 0,29 | R |
| 22 | [30] | Türkiye | Chemistry/HighSchool | Argument DrivenInquiry Method | 45 | 2,01 | T |
| 23 | [7] | Indonesia | Physics/High School | Development of ADI-based LKS | 20 | 0,29 | R |
| 24 | [26] | Türkiye | Science/Teacher | Enactment of Argumentation | 3 | 0,35 | S |
| 25 | [31] | Indonesia | Physics/High School | Implementation of the ADI Model | 85 | 0,53 | S |
| 26 | [34] | Türkiye | Senior High School | Argument Research InScience | 46 | 0.43 | S |
| 27 | [14] | Indonesia | Senior High School | ADI & Critical Thinking | 69 | 1,56 | T |
| 28 | [26] | Taiwan | Science/ ElementarySchool | Critical Thinking | 58 | 0,52 | S |
| 29 | [34] | Türkiye | Science/Teacher | Utilizing Argument Driven Inquiry | 50 | 0,42 | S |
| 30 | [35] | Indonesia | Biology/High School | ADI and Critical Thinking | 37 | 0,31 | S |
| **Rate** | | | | | | **0,67** | **T** |

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Results of the study regarding the effects of the model ADI from various levels of education. From elementary school, middle school, high school, to college. This shows that the model ADI can be applied at various levels of education from elementary school to tertiary level. Based on a study of meta-analysis results from several journals, it can be seen that the results are average Effect Size (ES) is 0.63 and is categorized namely "High". This shows that the ability to learn using models Inquiry Argument Driven Inquiry (ADI) has quite an effective influence in providing a positive impact on improving students' critical thinking skills.

The highest research is Eymur's research [30] have Effect Size the highest is 2.1. Because in this research a model is used ADI has a high effect on students' critical thinking skills at school. Research findings reveal that the application of the ADI learning model has an impact on students' critical thinking abilities, both those with high and low academic abilities with effectiveness in the high category. However, the ADI learning model has a greater influence and is more effective in improving the critical thinking abilities of students who have high academic abilities than those who have low academic abilities.

The lowest research is found in research by Kumdang [15]. Categorized of effect size is “Low”, this shows the use of the Argument Driven Inquiry model. No correlation was found between students' capacity to produce new and different ideas (originality). In this study, deficiencies were examined quantitatively, not qualitatively. Learning with other methods may be able to overcome the quality deficiencies produced by students who think differently.

Comparison of effect sizes between countries based on this analysis shows that the effect size in Turkey is in the "high" category with an average effect size value of 0.79, the effect size in Indonesia is in the "Medium" category with an average effect size value. size is 0.49. The effect size in America is in the "high" category with an average effect size value of 0.93. The effect size in Taiwan is in the "medium" category with an effect size value of 0.52 and the effect size in Thailand is in the "medium" category with an effect size value of 0.40. Based on the average effect size value from several countries that conducted research related to the ADI model and critical thinking skills, America is the country with the highest effect size value. This shows that the ability to learn using the model inquiry Argument Driven Inquiry (ADI) has quite an effective influence in providing a positive impact on improving students' critical thinking skills in America.

Comparison of the effect size of educational levels based on this analysis shows the average value of the effect size at the elementary school level it is considered "medium" with an average value of 0.49. Middle school is in the "medium" category with an average score of 0.49, at high school level it is in the "high" category with an average score of 0.85, and students are " high" with an average score of 0.75. This indicates that the model ADI has an effective impact on students' critical thinking skills, especially in high school and college.

Comparison of effect sizes in the fields of study based on this analysis shows the average effect size value in the science study field it is in the medium category with an average value of 0.48, in the chemistry study field it is in the high category with an average value of 0.81, in the biology study field it is in the medium category with an average value of 0.46. And in the field of physics studies, it is in the medium category with an average value of 0.37. This indicates that the model ADI has an effective impact on students' critical thinking skills in all fields of science study, especially in the field of chemistry study. In general, the results of research on science learning using ADI able to actively involve students in learning and able to develop critical thinking skills.

Critical thinking skills can be realized through activities analyzing phenomena that occur in everyday life, but in reality students' critical thinking skills in Indonesia are still relatively low [35]. For this reason, using the Argument Driven Inquiry model will really help students improve critical thinking skills. Using the ADI model can help students to achieve many components of scientific literacy such as developing critical thinking skills [30]. Using the ADI model students will be required to design and implement their own methods for collecting and analyzing data, communicate and justify their ideas with others duringinteractive argumentation sessions, write investigative reports to share and document their work, and engage in peer review [28] these stages indirectly encourage students to think critically because students are required to be able to identify each of these stages. Being able to identify flaws in an argument shows critical thinking skills [30].

## CONCLUSION

Based on the results of the analysis, the model is used Argument Driven Inquiry in improving students' critical thinking skills, it has a positive impact. Based on the results of analysis from research conducted in several countries with science study fields

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IJCSRR @ 2024
www.ijcsrr.org

related to the Argument Driven Inquiry learning model and critical thinking skills, an average ES of 0.63 was obtained, which is included in the (high) category. In Indonesia the use of models Argument Driven Inquiry to improve critical thinking skills is still relatively moderate so there needs to be further improvement in the use of the Argument Driven Inquiry model in an effort to improve students' critical thinking skills.

**REFERENCES**

1. Fatmawati, Z.A., Susilowati, S.M.E., & Prihandono, R.S.I. 2019. Effect of Argument Driven Inquiry (ADI) with Problem Solving Method for Student's Argumentation and CriticalThinking Skills. *Journal of Innovative Science Education*, Vol 8(3).
2. Khoiri, N., Sugandi, K., & Siswanto, J. 2022. The Validity of the Sustainability Based Argument-Driven Inquiry toImprove Students' Critical Thinking Skills. *Gagasan Pendidikan Indonesia*, Vol 3(1)
3. Fadilah, S., Jatmiko,B., & Prastowo, T. 2020. Validity and Effectiveness of Argument-Driven Inquiry Model with Contextual Approaches to Improve Critical Thinking Skills in Science Learning. *Studies in Learning and Teaching*, Vol1(2).
4. Permata, D., Hasnunidah, N., & Surbakti, A. 2019. Pengaruh Argument Driven Inquiry Terhadap Keterampilan Berpikir Kritis pada Materi Sistem Pencernaan. Jurnal Bioterdidik, Vol 7(13)
5. Nuryanti, L., Zubaidah, S., & Diantoro, M. 2018. Analisis Kemampuan Berpikir Kritis Siswa Smp. *Jurnal Pendidikan*,Vol 3(2)
6. Wulandari, D., Liliasari, S., & Widhiyanti, T. 2020. The effect of argument-driven inquiry on chemistry reactionrates to enhance pre-service chemistry teachers critical thinking skills. *Journal of Physics: Conference Serie*s, Vol 1922)
7. Putri, R.A. & Admoko, S. 2022. Development of Student Worksheets Based on Argument-Driven Inquiry LearningModel to Improve Students' Critical Thinking Skills. *Prisma Sains: Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram*, Vol 10 (3)
8. Ika, Y., Pratiwi, H. Y., & Sundaygara, C., 2020. Analisis Kemampuan Berpikir Kritis Ditinjau Dari Keterampilan Argumentasi Siswa Melalui Model Argument Based Science Inquiry (Absi). *Jurnal Riset Dan Kajian Pendidikan Fisika*, Vol 7(2), 93-100
9. Admoko, S., etc. 2021. The implementation of Argument Driven Inquiry (ADI) learning model to improve scientific argumentation skills of high school students. *Journal of Physics: Conference Series*, Vol 1(17)
10. Angeline, V., Situmorang, R.P., & Sastrodihardjo, S. 2018. Korelasi Keterampilan Argumentasi Dan Hasil Belajar SiswaSma Kristen Satya Wacana Pada Materi Genetika dengan Model ABSI, *Jipva (Jurnal Pendidikan Ipa Veteran)*, Vol 2, (1)
11. Nufus, H., Rosidin, U., Herlina, K., & Hasnunidah, N. 2018. Pengaruh Penerapan Model Argument-Driven Inquiry Terhadap Keterampilan Berpikir Kritis Siswa Smp Berdasakan Perbedaan Kemampuan Akademik. *Jurnal PendidikanFisika*, Vol 7(2)
12. Ying-Yan Lu., Etc. The Effects Of Critiquedriven Inquiry Intervention On Students' Critical Thinking And ScientificInquiry Competency. *Journal of Baltic Science Education*, Vol 19(6)
13. Suliyanah., Fadhilah, R.N., & Deta, U.A. 2020. The Process of Developing Students' Scientific Argumentation SkillUsing Argument-Driven Inquiry (ADI) Model in Senior High School on The Topic of Elasticity. *Journal Of Physics*,
14. Fitriani, Y.S. Juanda, A., & Roviati, E. 2020. Internalization of Religious Values Using the Argument-Driven InquiryModel to Improve Critical Thinking Skills during the COVID-19 Pandemic. *BIOSPHERE: Journal of Biology Tadris*,Vol 11(2)
15. Kumdang, P., Kijkuakul, S., & Chaiyasith, W. C. 2018. An Action Research on Enhancing Grade 10 Student Creative Thinking Skills using Argument-driven Inquiry Model in the Topic of Chemical Environment. *Journal Of Science Learning*, Vol 2(1)
16. Rosidin, U., Kadaritna, N., Hasnunidah, N. Can Argument-Driven Inquiry Models Have Impact On Critical ThinkingSkills For Students With Differentpersonality Types?. *Cakrawala Pendidikan*, Vol 38 (3)
17. Walker, J.P., Sampson, V., & Zimmerman, C.O. 2011. Argument-Driven Inquiry: An Introduction to a New Instructional Model for Use in Undergraduate Chemistry Labs. *Journal Of Chemical Education*, Vol 8(8)
18. Sadewa, I. K. I. D., Rosidin, U., & Distrik, I. W. 2020. Pengaruh Penerapan Model Argument Driven Inquiry terhadap Keterampilan Berpikir Kritis Siswa SMP Berdasarkan Perbedaan Gaya Belajar. Titian Ilmu: *Jurnal Ilmiah Multi Sciences*, Vol 12(1) hal 14-23

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 07 Issue 06 June 2024
DOI: 10.47191/ijcsrr/V7-i6-39, Impact Factor: 7.943
IJCSRR @ 2024
www.ijcsrr.org

19. Grooms, J., Enderle, P., Sampson, V. 2015. Coordinating Scientific Argumentation and the Next Generation Science Standards through Argument Driven Inquiry. *Science Educator*, Vol 4(1)
20. Kadayifci, H., Atasoy, B., & Akkus, H. 2012. The Correlation Between The Flaws Students Define an Argument andTheir Creative and Critical Thinking Abilities. *Procedia – Social Dan Behavioral Sciences*, 47, 802–806.
21. Demircioglu, T. 2012. The effect of argument-driven inquiry on pre-service science Teachers Attitudes andArgumentation Skills. *Procedia - Social and Behavioral Sciences*, Vol 4 (6)
22. Nazila,L., Rosidin, U., Distrik, I. W., Herlina, K., & Hasnunidah, N. PENGARUH PENERAPAN MODEL ARGUMENT DRIVEN INQUIRY (ADI) TERHADAP KETERAMPILAN BERPIKIR KRITIS SISWA SMP BERDASARKAN PERBEDAAN JENIS KELAMIN. *Journal of Physics and Science Learning*, Vol 2(2
23. Sampson, V., Grooms, J., & Walker, J.P. 2010. Argument-Driven Inquiry as a Way to Help Students Learn How toParticipate in Scientific Argumentation and Craft Written Arguments: An Exploratory Study. *Wiley Online Librar*
24. Ulhaq, Z. S., dan Rahmayanti, M. 2020. *Panduan Penulisan Skripsi Literatur Review*. Fakultas Ilmu Kedokteran danIlmu Kesehatan UIN Maulana Malik Ibrahim.
25. Tiara, D. R., & Pratiwi, E. (2020). Pentingnya Mengukur Kesiapan Guru Sebagai dasarPembelajaran Daring di Lembaga PAUD. Jurnal Golden Age, Universitas Hamzanwadi, 04(2), 362–368.
26. Sengul, O., Enderle, P.J., & Schwartz, R.s. 2021. Examining science teachers' enactment of argument-driven inquiry(ADI) instructional model. *International Journal Of Science Education*
27. Demircioglu, T. 2015. Investigating the Effect of Argument-Driven Inquiry in Laboratory Instruction. *EducationalSciences: Theory & Practice*, Vol 15, (1)
28. Walker, J.P., etc. 2012. Argument-Driven Inquiry in Undergraduate Chemistry Labs: The Impact on Students' Conceptual Understanding, Argument Skills, and Attitudes Toward Science. *Journal Of College Science Teaching*, Vol41(4).
29. Walker, J.P., & Sampson, V. 2015. Learning to Argue and Arguing to Learn: Argument-Driven Inquiry as aWay to Help Undergraduate Chemistry Students Learn How to Construct Arguments and Engage in Argumentation During a Laboratory Course. *Journal Of Research In Science Teaching*, Vol 50 (5)
30. Eymur, G. 2019. The influence of the explicit nature of science instruction embedded in the Argument-Driven Inquirymethod in chemistry laboratories on high school students' conceptions about the nature of science. *Royal Society Of Chemistry*, Vol 20(17).
31. Admoko, S., etc. 2021. The implementation of Argument Driven Inquiry (ADI) learning model to improve scientific argumentation skills of high school students. *Journal of Physics: Conference Series*, Vol 1(17)
32. Kacar, S., & Balim, A.G. 2021. Secondary School Students' Views About the Use of Argument-Driven Inquiry in theScience Courses1. *Journal of Qualitative Inquiry (TOJQI)*, Vol 12(1)
33. Ying-Yan Lu., Etc. The Effects Of Critiquedriven Inquiry Intervention On Students' Critical Thinking And ScientificInquiry Competency. *Journal of Baltic Science Education*, Vol 19(6)
34. Erenler, S., & Cetin, P.S. 2019. Utilizing Argument-Driven-Inquiry to Develop Pre-Service Teachers' Metacognitive Awareness and Writing Skills. *International Journal of Research in Education and Science*, Vol 5(1)
35. Salsabela, A.I., & Puspitawati, R.P. 2020. The Validity Of Student Worlsheets Based On Argument Driven Inquiry (ADI) In Cell Structure And Plant Tissue Material To Train Critical Thingking Skills For Senior High School Students.*Bioedu*. Vol 9(1)

***Cite this Article: Yolanda Eka Putri, Neni Hasnunidah, Undang Rosidin (2024). Meta-Analysis the Effectiveness of Implementing the Argument Driven Inquiry (ADI) Model in Improving Students' Critical Thinking. International Journal of Current Science Research and Review, 7(6), 3891-3897***