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META-ANALYSIS OF THE EFFECT OF THE USE OF JIGSAW TYPE COOPERATIVE MODEL ON STUDENT LEARNING OUTCOMES IN LEARNING NATURAL SCIENCE IN JUNIOR HIGH SCHOOL AND PHYSICS IN SENIOR HIGH SCHOOL

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ABSTRACT

This meta-analysis study aims to analyze the effect size of the use of the jigsaw cooperative model based on education level, material units, and aspects of learning outcomes including knowledge, attitudes, and skills. The research method used was a meta-analysis of 25 articles that have been published in various national and international journals and proceedings. The results of this study were as follows: (1) The use of the type cooperative model jigsaw in improving learning outcomes based on education level more have an effect on the high school level; (2) The use of the jigsaw type cooperative model in improve learning outcome based on material units more influential on units optics and thermodynamics material for high school level and affect the unit thermodynamics and vibration & wave materials for junior high school level; (3) The use of the type cooperative model jigsaw in improving learning outcomes has an effect on aspects of attitude, knowledge, and skills.

Keywords: *Meta-Analysis; Jigsaw Cooperative Type; Student Learning Outcomes.*

I. INTRODUCTION

Among the indicators of the quality of human resources is the level of education. Education is a necessary field of development in every country. Through education, students are given provisions that can provide experience in improving their lives so that they can develop according to the progress of the times. Education is an important aspect in life that can produce resources quality human being to be a provision in the future [1]. The quality of education describes the quality of human resources. By the concept of education modernization, the primary goal of the higher school are the formation of the graduate's creative personality with a set of competencies that are manifested in the ability to solve problems and challenges on various spheres of human activity, a graduate who is capable of self-development, self-education, professional development, and possesses social and professional mobility and is capable of innovation activities [2].

The implementation of education in Indonesia requires the participation of all parties, especially the role of the government. The government always implements various ways to advance the quality of education in Indonesia. The government distributes scholarship assistance to teachers and students, improves the quality and quality of teachers, and builds educational facilities and infrastructure, and makes curriculum changes. The curriculum used now is the new curriculum as a result of improvements from the old curriculum.

Natural Sciences and Physics are subjects in the new curriculum. Science is a science that focuses on the ability of students to be active in the learning process of the exploration process. In particular, current education seeks to help students learn to organize and construct opinions, formulate problems, develop hypotheses, and find evidence for themselves [3] and physics is a field of science that produces scientific components in the form of patterns of thinking, behavior and is carried out through scientific steps such as observation, problem formulation, hypothesis formulation, hypothesis testing, experimentation, making conclusions, to the discovery of a theory and concept through learning [4].

Through a review of 25 articles obtained, it is stated that the actual conditions in the field are not in line with the expected ideal conditions. Physics learning carried out in schools is still carried out in one direction so that learning that should be student-centered has not been implemented optimally, students have not been actively involved in solving various problems from the material. Physics he studied. As a result, students have not been able to interpret the material being studied with phenomena that occur to nature [5]. The formation of discussion groups is not effective Students may also think that seeking help can be interpreted as evidence for low ability [6] and the lack of positive collaboration between students in the learning process, students who have high knowledge have less role in directing their peers who have medium or low abilities. Causing some students to appear more dominant than other students, resulting in a gap between students and other students [7]. Interaction between students is also rare so that cooperation between students is not well-developed, so the learning process becomes boring and less fun [8].

The second real condition of learning physics is said to be difficult for most students [9]. most students learn physics by using the formula for understanding its physical meaning, so that physical is only considered as a lesson consisting of a collection of formulas that must be memorized [10]. Students do not like studying physics and increase the time of physics learning at school and home. Students will feel dizzy if physics lessons at school multiplied. Students never read physics books at home except only if there will be a repeat or a semester exam. Students who have no interest in spending time studying physics do not do homework at home but work in school [11]. Students are still not accustomed to understanding physics material that is abstract and foreign by students, causing less meaningful learning of physics so that students become bored and student learning outcomes are low [12]. Learning physics is still a textbook, a lot of memorization, and a lot of studying formulas [13]. In the physics learning process, it was found that the knowledge dimension had not been implemented properly [14].

The real condition of the three teachers was less than optimal in applying the selected model and the teacher applied more direct learning activities in the classroom. The teacher has not maximally applied the learning model. As a result, students are passive and do not develop. Another obstacle found in the learning process is the teacher's lack of understanding of the learning model.

From the problems that has been described, it is known that there are different conditions in the field with the ideal conditions that should be. To solve these problems, efforts are needed to improve the physics learning process, namely the selection of appropriate learning models. The learning model must be appropriate with basic competencies and material characteristics of learning [15]. Various models of which are cooperative. This model has various types, one of which is the jigsaw cooperative type.

II. METHOD

The research is applied to meta-analysis research. Study meta-analysis is defined as the study of several research results of similar problems [16]. The meta-analysis include research that is quantitative because it calculates it with numbers and statistics to adapt reports from many data sources. We conducted searches of electronic databases, manually searched for important publications, and also searched for relevant cited references to the identified research articles. The primary data sources of the study included journal articles, conference papers, and doctoral dissertations indexed in the Web of Knowledge Social Sciences Citation Index or the ERIC database [17]. The procedure for this meta-analysis is as follows: (1) Determining the selection criteria and understanding the topics to be summarized; (2) Strategies in browsing articles and who will browse the library; (3) clear categories in assessing the quality of research articles covering aspects of design, implementation, and analysis; (4) grouping and compiling research units to be grouped; (5) Planning the use of appropriate statistical models in combining the results; (6) calculate the effect size; (7) identify the heterogeneity of effect size; (8) Summarizing and interpreting the research results [18].

The technique in taking samples using the purposive sampling technique. The sample that has been searched is 25 articles. There are certain objectives in the research, namely: (1) the articles taken are articles written by students or researchers; (2) The article taken is the title with the experimental research method; (3) Articles sourced from various journals and proceedings; (4) The article contains statistical effect size data and is included in quantitative research; (5) Articles of the theme of jigsaw cooperatives model on junior high school science material and high school physics; (6) The sample taken from the level of education in the article is the junior high school and Senior high school levels.

The analysis technique used a quantitative approach to the calculation and analysis of the data already in the article. To analyze the data using effect size namely: (1) Equation of effect size of one sample group, if it is known that the average pretest-posttest and standard deviation pretest-posttest; (2)The equation for the test of the difference between the two sample groups is related if it is known that there is only the posttest mean and standard deviation from the two sample groups; (3) The equation for the test of two groups of related samples if the mean and standard deviation from the pretest and posttest of the two groups are known; (4) The equation for the different

test of two related sample groups if the control member and the experimental member both has at-count value and have the number of students in both [19]. The following are criteria for effect size, namely:

Tabel 1. Effect Size Criteria (ES)

No	*Effect Size*	Criteria
1.	ES ≤ 0,15	Very Low
2.	0,15 < ES ≤ 0,40	Low
3.	0,40 < ES ≤0,75	Currently
4.	0,75 < ES ≤1,10	High
5.	1,10 < ES ≤ 1,45	Very High

III. RESULTS AND DISCUSSION

The data analyzed in this study amounted to 25 articles, of which 24 were national articles and 1 international article. Articles are grouped based on high school and junior high school education levels, material units, and learning outcomes aspects of knowledge, attitudes, and skills. The following are the results of the research.

1. Based on the education level.

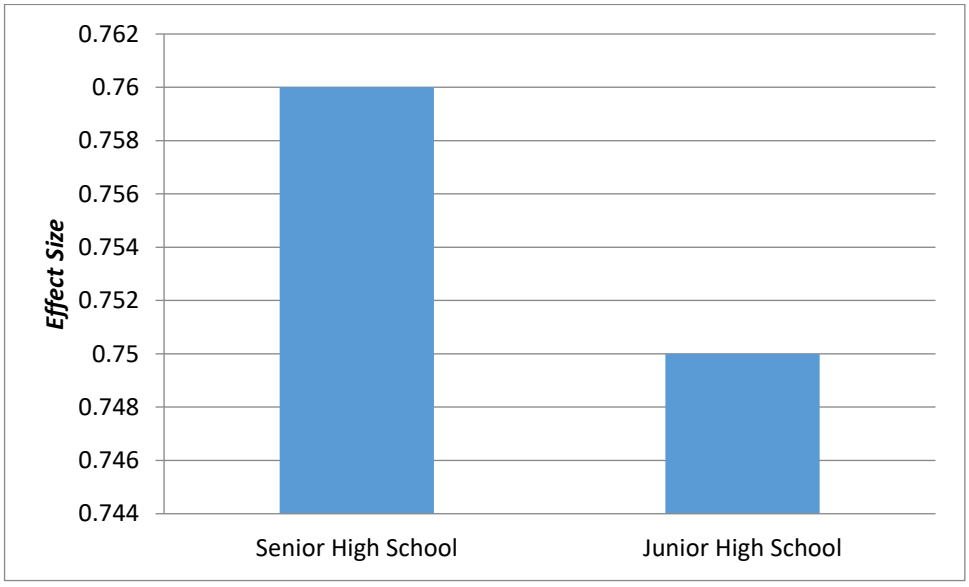

Fig. 1. Education Level

It can be understood that it turns out that both high school and junior high school levels use the jigsaw cooperative model to calculate the effect size on the high criteria. So that the use of the jigsaw cooperative model for high school and junior high school levels has a significant effect on student learning outcomes. However, when compared, it is better at the high school level than in junior high school.

2. Based material unit.

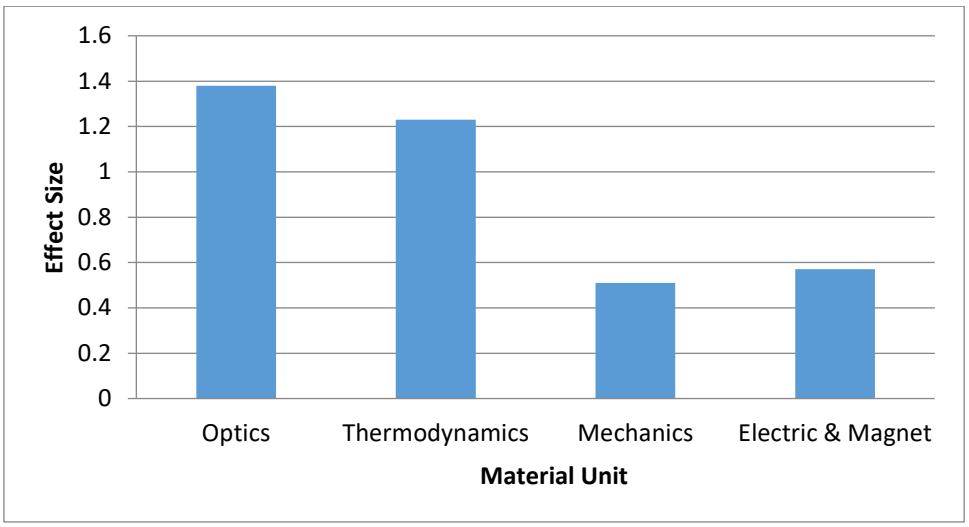

Fig. 2. Senior High School

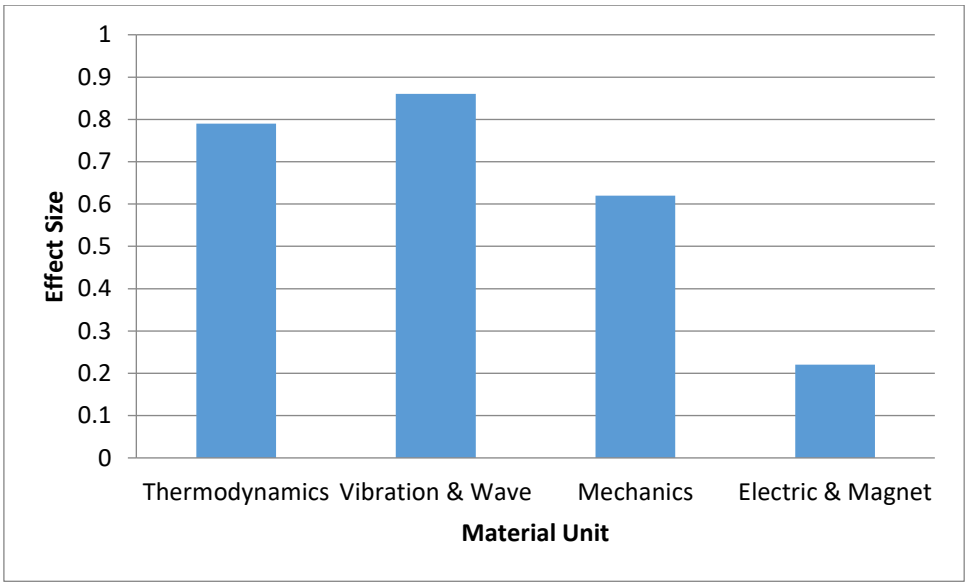

Fig. 3. Junior High School

It can be seen that at the high school level for optical and thermodynamic material units, the results of calculating effect size of very high criteria and units of mechanics, electricity & magnetism obtained effect size calculations on medium criteria. At the junior high school level for the thermodynamics and vibration & wave material units, the results of the calculation of the effect size of the high criteria, and for the mechanical material on the medium criteria and the electric magnetic material unit on the low criteria. So the use of this model has a significant effect on student learning outcomes of the thermodynamics material unit at the high school and junior high school levels. Meanwhile, the optical material unit has a significant effect on the high school level, for the vibration & wave material unit it has a significant effect at the junior high school level.

3. On aspects of learning outcomes.

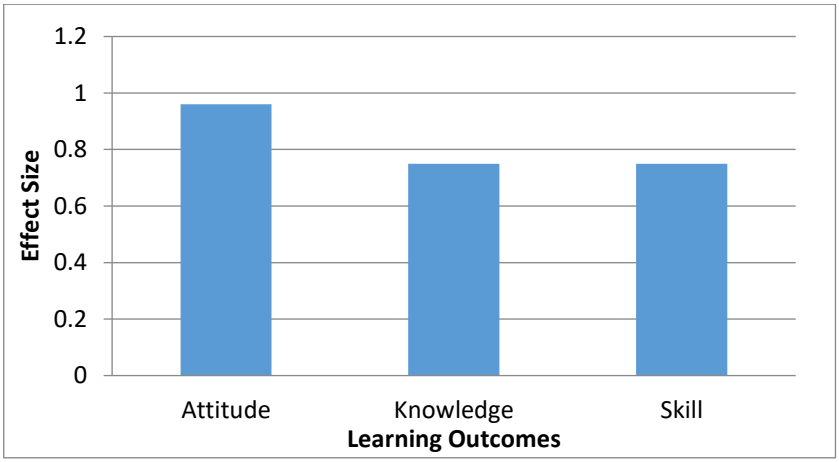

Fig. 4. Senior High School

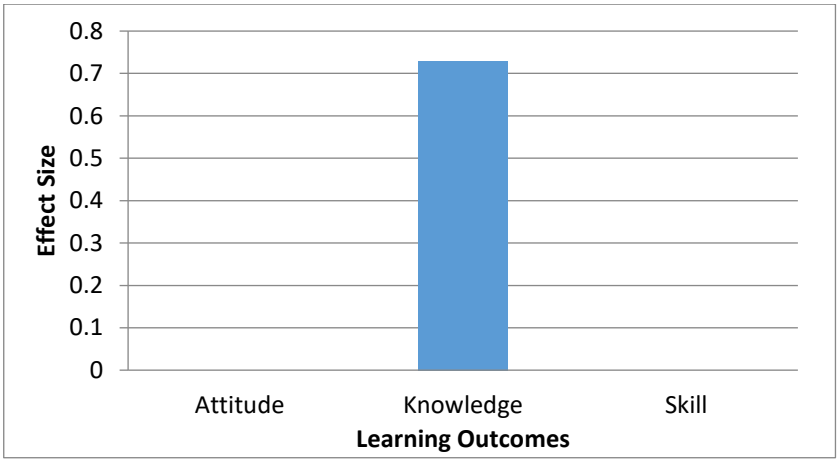

Fig. 5. Junior High School

It can be seen that at the high school level for optical and thermodynamic material units, the results of calculating effect size on very high criteria and units of mechanics, electricity & magnetism obtained effect size calculations on medium criteria. At the junior high school level for the thermodynamics and vibration & wave material units, the results of the calculation of the effect size of the high criteria, and for the mechanical material on the medium criteria and the electric magnetic material unit on the low criteria. So the use of this model has a significant effect on student learning outcomes of the thermodynamics material unit at the high school and junior high school levels. Meanwhile, the optical material unit has a significant effect at the high school level, for the vibration & wave material unit has a significant effect on the junior high school level.

The first result is based on education level, the calculation of the effect size of high school level with 13 articles obtained a value of 0.76 high criteria and for junior high school level with 12 articles, the value is 0.75 high criteria. This proves that the high school and junior high school levels can improve student learning outcomes. However, when compared to the high school level, it is better than the junior high school level. A child's social thinking is influenced by his cognitive maturity. Based on this, the higher the level of education of a student, the more effective in learning. Because the cognitive maturity of a student can be formed into a learning process that is repeated and carried out continuously. In general, high school students have higher emotional maturity than junior high school students.

The second result are based on the material unit after analyzing the 5 material units in the article, it was obtained for the high school level the highest effect size result was in the optical material unit, namely 1.38 with very high criteria, and continued with the thermodynamics material unit with an effect size value of 1.23 very high criteria. Then the unit of mechanical and electrical magnetic material is in the medium criteria. At the junior high school level, the result of the highest effect size was in the vibration & wave material unit with an effect size value of 0.86 with a high criterion, followed by a thermodynamic material unit, which was 0.79 with a high criterion. Then the unit of mechanical material with an effect sizes value of 0.62 with moderate criteria and an electric magnet for an effect sizes value of 0.22 with low criteria. in line with [20] the opinion that other important problems

of the physical matter is electricity and magnetism. Research has shown that students have more difficulty with magnetism even though they encounter more examples of problems with magnetism than with electricity in their daily life. It is stated that using complex mathematical operations for magnetic and notional teaching of subjects through complex verbal symbols to learn problems. Furthermore, it was found in related studies that students had products of the issues of changing the brightness of lamps with changes in resistance, current, series and parallel relations of resistance, ohm's law, and circuit theory. It turned out that in the learning process the use of the jigsaw cooperative model for optical, vibration & wave, and thermodynamic material units was better than the mechanical and electrical magnetic material units.

The third result on the aspect of learning outcomes, at the high school level the calculation of the effect size of the attitude aspect obtained an average of 0.96 with very high criteria, knowledge, and skills aspects of 0.75 with high criteria. This shows that the use of the jigsaw cooperative model affects aspects of knowledge, attitudes, and skills. However, when compared, it is more influential in the aspect of attitude. By the articles that has been analyzed which state the achievement of attitudes, it can be seen that students that are given the jigsaw model are actively learning. Students who have a high scientific attitude dare to express their opinions. In addition, be optimistic about every action taken. At the junior high school level, the calculation of the effect size of the knowledge aspect obtained an average of 0.73 with moderate criteria. By the article that has been analyzed, it states that the Jigsaw type cooperative model is very well applied, by using this model, a student will explore the material being studied. They are also required to be able to become tutors in their friends of the group. However, at the junior high school level, there is no research article on aspects of attitudes and skills, so this shows that teachers only focus on aspects of knowledge and do not pay attention to student learning outcomes for aspects of attitudes and skills. Such as the opinion of Karacop [21], it is revealed that the Jigsaw method both for the theoretical and practical aspects of science courses gives importance to students in the realm of knowledge, skills, and effectiveness as well as the development of students' scientific process skills.

IV. CONCLUSION

According to the analysis and description of the research results that have been carried out, the following conclusions are obtained: (1) The value of the effect size of the high school level is 0.76 high criteria and 0.75 high criteria junior high school. The use of the jigsaw type cooperative model in improving learning outcomes based on education level is more influential at the high school level compared to junior high school; (2) The value of effect size of the high school level for optical material units is 1.38 very high criteria, thermodynamics 1.23 very high criteria, mechanics 0.51 moderate criteria, and electricity & magnetism 0.57 moderate criteria. At the junior high school level, the thermodynamics unit is 0.9 high criteria, vibration & waves criteria are 0.86 high criteria, mechanics is 0.62 moderate criteria and electric magnets is 0.22 low criteria. The use of a jigsaw cooperative models on improving learning outcomes based on material units, has more effect on optical and thermodynamic material units for high school level and has an effect on thermodynamics and vibration & wave material units for junior high school level; (3) The value of the effect size aspect of learning outcomes of the high school level for the attitude aspect is 0.96 very high criteria, the knowledge and skill aspect is 0.75 high criteria. At the junior high school level for the knowledge aspect of 0.73 medium criteria. The use of jigsaw cooperative models on improving learning outcomes has an effect on aspects of attitudes, knowledge, and skills.

REFERENCES

[1] R. Wahyu Kurnia, Hidayati, "Pengaruh Penerapan Virtual Lab Berbantuan LKPD Menggunakan Model Pembelajaran Kooperatif Tipe Group Investigation Terhadap Kompetensi Peserta Didik Kelas XI SMAN 5 Padang," *Pillar Phys. Educ. Vol. 10. Oktober 2017, 161-168*, vol. 10, hal. 161–168, 2017.

[2] V. Y. Shurygin dan L. A. Krasnova, "Electronic learning courses as a means to activate students' independent work in studying physics," *Int. J. Environ. Sci. Educ.*, vol. 11, no. 8, hal. 1743–1751, 2016, doi: 10.12973/ijese.2016.551a.

[3] Septi Budi Sartika dan Noly Shofiyah, "Psychomotor Skills of Pre-service Teachers of Natural Science on Melde's Experiment in Guided Inquiry Learning," *IJORER Int. J. Recent Educ. Res.*, vol. 1, no. 2, hal. 108–115, 2020, doi: 10.46245/ijorer.v1i2.32.

[4] N. Khasanah dan Y. Hidayati, "Pengaruh Pengguunaan LKS Berbantuan Media PowerPoint yang Dilengkapi Animasi pada Model Direct Instruction terhadap Pencapaian Kompetensi Fisika Siswa Kelas X SMAN 5 Bukittinggi," *Pillar Phys. Educ.*, vol. 10, no. 1, hal. 65–72, 2017.

[5] D. Anggraini, A. Putra, dan Z. Kamus, "Pengaruh Aspek Kecerdasan Komprehensif Dalam Bahan Ajar Terhadap Pencapaian Kompetensi Siswa Pada Pembelajaran Fisika di Kelas X SMAN 3 Padang Staf Pengajar Jurusan Fisika , FMIPA Universitas Negeri Padang," *Pillar Phys. Educ.*, vol. 7, no. April, hal. 25–32, 2016.

[6] K. Dunnett, M. N. Gorman, dan P. A. Bartlett, "Assessing first-year undergraduate physics students' laboratory practices: Seeking to encourage research behaviours," *Eur. J. Phys.*, vol. 40, no. 1, 2019, doi:

10.1088/1361-6404/aaf13b.
[7] E. Trisianawati, T. Djudin, dan R. Setiawan, "Pengaruh Model Pembelajaran Kooperatif Tipe Jigsaw Terhadap Hasil Belajar Siswa Pada Materi Vektor Di Kelas X SMA Negeri 1 Sanggau Ledo," *J. Penelit. Fis. dan Apl.*, vol. 6, no. 2, hal. 51–60, 2016, doi: 10.26740/jpfa.v6n2.p51-60.
[8] U. Fitri, Y. Darvina, dan Murtiani, "Pengaruh Penerapan Model Pembelajaran Kooperatif Tipe Jigsaw II Berbantukan Bahan Ajar Bermuatan Nilai-Nilai Karakter Terhadap Kompetensi Siswa Kelas XI SMAN 5 Padang," *Pillar Phys. Educ.*, vol. 7, hal. 121–128, 2016.
[9] M. M. Keller, K. Neumann, dan H. E. Fischer, "The impact of physics teachers' pedagogical content knowledge and motivation on students' achievement and interest," *J. Res. Sci. Teach.*, vol. 54, no. 5, hal. 586–614, 2017, doi: 10.1002/tea.21378.
[10] S. F. A. Yudha, Asrul, dan Z. Kamus, "Pembuatan Bahan Ajar Fisika Berbasis Video Menggunakan Sparkol VideoScribe Untuk Pembelajaran Fisika Peserta didik Kelas X SMA," *Pillar Phys. Educ.*, vol. VIII, hal. 154, 2016, [Daring]. Tersedia pada: http://ejournal.unp.ac.id/students/index.php/pfis/article/view/2476.
[11] D. Darmaji *et al.*, "International Journal of Learning and Teaching," vol. 11, no. 3, hal. 99–109, 2019.
[12] N. N. S. P. Verawati, S. Rahayu, dan N. F. A. Detri, "Efek Model Pembelajaran Kooperatif Tipe STAD dan Jigsaw Terhadap Penguasaan Konsep Fisika," *JISIP (Jurnal Ilmu Sos. dan Pendidikan)*, vol. 4, no. 1, hal. 321–326, 2020, doi: 10.36312/jisip.v4i1.1126.
[13] F. Susilo, W. Sunarno, dan Suparmi, "Pembelajaran Fisika Menggunakan Model Jigsaw Dan GI (Group Investigation) Ditinjau Dari Kreativitas dan Sikap Ilmiah Belajar Siswa," *J. Inkuiri J. Pendidik. IPA*, vol. 5, no. 3, hal. 40–48, 2016, [Daring]. Tersedia pada: http://jurnal.fkip.uns.ac.id/index.php/sains.
[14] F. Rahmatika, A. Putra, dan Yurnetti, "Pengembangan LKPD Berorientasi Kompleksitas Konten dan Proses Kognitif Pada Materi Fluida Statis untuk Pembelajaran Fisika Kelas XI SMA/MA," *Pillar Phys. Educ.*, vol. 9, no. 1, hal. 121–128, 2017.
[15] D. Yarsina, S. Y. Sari, Y. Darvina, dan Asrizal, "Kajian Literatur Pengaruh LKS Inkuiri Terbimbing terhadap Hasil Belajar Fisika Siswa untuk Berbagai Jenjang Pendidikan," vol. 13, no. 3, hal. 467–474, 2020, [Daring]. Tersedia pada: http://repository.unp.ac.id/id/eprint/29845.
[16] F. Ayu, Festiyed, dan D. Djamas, "Meta-Analisis Tesis Pengembangan Bahan Ajar Fisika Sekolah Menengah Menggunakan Model Inquiry Based Learning (IBL) Untuk Meningkatkan Kompetensi Peserta Didik," *Pillar Phys. Educ.*, vol. 12, no. 4, hal. 841–848, 2019.
[17] Y. T. Sung, J. M. Yang, dan H. Y. Lee, "The Effects of Mobile-Computer-Supported Collaborative Learning: Meta-Analysis and Critical Synthesis," *Rev. Educ. Res.*, vol. 87, no. 4, hal. 768–805, 2017, doi: 10.3102/0034654317704307.
[18] A. E. G. Waluyohadi, "Meta-analysis Study of Achievement Motivation and Academic Achievement," *Psikodimensia*, vol. 18, no. 2, hal. 101, 2019, doi: 10.24167/psidim.v18i2.2023.
[19] S. Dinçer, "Effects of computer-assisted learning on students' achievements in Turkey: A meta-analysis [Tüürkiye'de yapilan bilgisayar destekli öğretimin öğrenci başarisina etkisi ve diğer ülkelerle karşilaştirilmasi: Bir meta-analiz çalişmasi]," *J. Turkish Sci. Educ.*, vol. 12, no. 1, hal. 99–118, 2015, doi: 10.12973/tused.
[20] A. Karacop, "The Effects of Using Jigsaw Method Based on Cooperative Learning Model in the Undergraduate Science Laboratory Practices," *Univers. J. Educ. Res.*, vol. 5, no. 3, hal. 420–434, 2017, doi: 10.13189/ujer.2017.050314.
[21] A. Karacop dan E. H. Diken, "The Effects of Jigsaw Technique Based on Cooperative Learning on Prospective Science Teachers' Science Process Skill," *J. Educ. Pract.*, vol. 8, no. 6, hal. 86–97, 2017, [Daring]. Tersedia pada: https://eric.ed.gov/?id=EJ1133003.