

Discovery Learning with Jigsaw II on Information Literacy and Cognitive Learning Outcomes of High School Students

Robiatul Adawiyah*, Herawati Susilo, Sri Endah Indriwati

Biology Education-Universitas Negeri Malang

Jl. Semarang 5 Malang 65145, Jawa Timur, Indonesia. E-mail: robiatul.wiwik23@gmail.com*

Abstract: This study aimed to determine the effect of the discovery learning model combined with Jigsaw II on the students' information literacy and cognitive learning outcomes. The study was a quasi-experimental with a non-equivalent control group design. The subjects were 134 high school students divided into one group given discovery learning model combined with Jigsaw II and 3 control groups given discovery learning, Jigsaw II, or conventional learning model. The experiment showed that the discovery learning model combined with Jigsaw II resulting in significant differences in students' information literacy and cognitive learning outcomes with $F_{\text{value}} = 13.935$ ($p < 0.05$) on information literacy $F_{\text{value}} = 6.527$ ($p < 0.05$) on cognitive learning outcomes. It can be concluded that the discovery learning model combined with Jigsaw II significantly improved students' information literacy and cognitive learning outcomes.

Key Words: discovery learning, jigsaw II, information literacy, cognitive learning outcomes

Abstrak: Penelitian ini bertujuan untuk mengetahui pengaruh model pembelajaran *discovery learning* dipadu Jigsaw II terhadap literasi informasi dan hasil belajar kognitif. Penelitian merupakan penelitian eksperimen semu dengan desain *nonequivalent control group design*. Subjek yang digunakan yaitu siswa SMA sebanyak 134 siswa. Hasil penelitian menunjukkan nilai F sebesar 13,935 dan taraf signifikan sebesar $0,000 < 0,05$ pada literasi informasi dan F sebesar 6,527 dan taraf signifikan sebesar $0,000 < 0,05$ pada hasil belajar kognitif. Hal ini dapat disimpulkan bahwa ada perbedaan signifikan literasi informasi dan hasil belajar kognitif siswa yang menjalani model pembelajaran *discovery learning* dipadu Jigsaw II.

Kata kunci: *discovery learning*, jigsaw II, literasi informasi, hasil belajar kognitif

INTRODUCTION

Twenty-first century education is the process of actualizing individual skills that are carried out throughout life (Pendidikan, 2010). One of the skills and innovation in learning that must be possessed by each individual is information literacy (Learning, 2015). Information literacy is a combination of knowledge, skills, and attitudes that are used to meet information literacy indicators which consist of identifying, accessing, evaluating, synthesizing, using, and communicating the information needed ethically and legally (Anunobi & Udem, 2014). An individual who has good literacy can solve problems encountered both in learning and in everyday life (Oméluzor & Bamidele, 2013).

PISA in its research on the reading interest of Indonesians with the subject of children aged 15 years (Gurria, 2015) found that Indonesian's reading interest was still very low (ranked 62 out of 70 countries). It further causes various problems, one of which is the large amount of false and inaccurate information that is spread among people. This also indicates that information literacy is also still low (Kemendikbud, 2016).

Based on a questionnaire given to 222 tenth graders of MAN Bangkalan, as many as 41% of students have not evaluated the information obtained and 57% have not used the information effectively and responsibly. This concludes that students' information literacy is still lacking, especially in analyzing the opinions

of themselves and others and evaluating the relevance of information obtained with the lesson being studied. In addition, students cannot use information as an expected learning goal.

Student's low information literacy influences the learning outcomes. The higher the student's information literacy, it follows the higher the learning outcomes (Murti & Winoto, 2018). The learning outcomes constitute output obtained by the student including known, understood, and implemented concepts (Potter & Kustra, 2012; Klefstad & Horgen, 2010). Cognitive learning outcome correlates with student's intellectual abilities such as remembering, understanding, implementing, analyzing, evaluating, and creating (Anderson & Krathwohl, 2001). The student is expected to be able to develop his/her understanding and implementation of a certain concept and thus teacher ought to apply learning model which support student's development (Syah, 2014).

The learning model that can be used to improve information literacy and student learning outcomes is Discovery Learning combined with Jigsaw II. The Discovery Learning syntax combined with Jigsaw II consists of reading and determining the origin and expert groups, expert group discussions (stimulation, problem statements, data collection, data processing, verification, and conclusions), team reports, tests, and team recognition (Widodo, Sujadi, & Riyadi, 2015; Fidanata, 2017). It has been reported that the application of discovery learning models can improve information literacy on indicators of searching, identifying, managing search strategies and connecting information sharing obtained by relevant problems, managing search strategies for information sources and connecting various information obtained (Aziz, 2017). Jigsaw II learning models that are integrated with project-based learning can increase student success in learning (Demir & Senemoglu, 2017), whereas. The Jigsaw II learning model can develop learning motivation and affect student learning outcomes (Al-salkhi, 2015).

The results of the initial analysis carried out found that 54% of students were in the category of average in terms of cognitive learning outcomes through a theoretical test with a form of multiple-choice questions

and essays (score range 72–81). Based on the aforementioned explanation, this study aims to determine the effect of the Discovery Learning learning model combined with Jigsaw II on information literacy and learning outcomes of tenth graders at MAN Bangkalan.

METHOD

This research was a quasi-experimental study with a non-equivalent control group design. This study involved 134 students from four classes of X Science MAN Bangkalan which were divided into three control classes, each of which was given discovery learning model, Jigsaw II, and conventional learning as well as one experimental class that was taught by discovery learning model combined with Jigsaw II. The research sample was determined by the random sampling method which had previously been tested for equality. The research instrument consisted of learning and assessment instruments. The learning instrument consisted of the syllabus, lesson plan, and student's worksheet. The assessment instrument consisted of pretest and posttest information literacy and cognitive learning outcomes that were previously tested for validity and reliability. Data were analyzed through a one-way covariance analysis and continued with Least Significance Difference using statistical processing software.

RESULTS

Result of Information Literacy Learning

The result of this study shows an average score increase over the posttest from the pretest achieved by the class that used discovery learning model integrated with Jigsaw II of 40,5%, discovery learning model of 35,68%, Jigsaw II learning model of 34,63%, and conventional learning model of 26,74%. The result of the hypothesis test using one-way analysis of covariance shows different information literacy between students who learned through discovery learning integrated with Jigsaw II, discovery learning, Jigsaw II, and conventional learning model ($F_{\text{count}} = 13,935$; $0,000 < 0,05$) (Table 1). The result of further testing

Table 1. Pretest and Posttest Average Score on Information Literacy

Class	Average		Increase (%)	F _{count}
	Pretest	Posttest		
Discovery Learning combined with Jigsaw II	62,02	87,14	40,5	13,935
Discovery Learning	60,77	82,45	35,68	
Jigsaw II	62,63	84,32	34,63	
Conventional	62,38	79,06	26,74	

on the effect of discovery learning integrated with Jigsaw II, discovery learning, Jigsaw II, and conventional learning model on information literacy through LSD further testing shows that discovery learning integrated with the Jigsaw II learning model significantly differences from discovery learning and conventional learning model. However, it does not show a significant difference from the Jigsaw II learning model (Table 2).

Result of Cognitive Learning

The result of this study also shows an average score increase over the posttest from the pretest on the cognitive learning achieved by the class that used discovery learning model integrated with Jigsaw II of 33,84%, discovery learning model of 21,29%, Jigsaw II learning model of 16,38%, and conventional learning model of 18,00%. The result of hypothesis test using one-way analysis of covariance shows differences on the cognitive learning result between students who learned through discovery learning integrated with Jigsaw II, discovery learning, Jigsaw II, and conventional learning model (value $F_{\text{count}} = 6,527$; significance level $0,000 < 0,05$) (Table 3). The result of further testing on discovery learning, Jigsaw II, discovery learning integrated with Jigsaw II, and con-

ventional learning model shows that discovery learning integrated with Jigsaw II is significantly different from the conventional learning model. However, it does not show a significant difference from Jigsaw II and the discovery learning model (Table 4).

DISCUSSION

Discovery Learning Integrated with Jigsaw II Learning Model Improves Information Literacy

This study successfully validates that discovery learning integrated with Jigsaw II potentially improves ten graders students' information literacy. The improvement of information literacy comes from the role of the syntax of discovery learning integrated with Jigsaw II. The syntax consists of reading and deciding the initial also the expert group, expert group discussion (stimulation, problem statement, data collection, data processing, verification, and concluding), and groups' report. The reading activity is carried out by all of the students on all of the topics to obtain the related information ahead of deciding the information required by each of the expert groups (Slavin, 2010). This also improves students' information literacy over the finding and evaluating information indicator (Hisle & Webb,

Table 2. Least Significance Difference Analysis of Discovery Learning combined with Jigsaw II, Discovery Learning, Jigsaw II, and Conventional Learning on Information Literacy

Class	Pretest	Posttest	Corrected Average	LSD Notation
Discovery Learning combined with Jigsaw II	62,02	87,14	87,135	c
Discovery Learning	60,77	82,45	82,603	a b
Jigsaw II	62,63	84,32	84,236	b c
Conventional	62,38	79,06	79,008	a

Table 3. Pretest and Posttest Average Score on Cognitive Learning Outcomes

Class	Average		Increase (%)	F _{count}
	Pretest	Posttest		
Discovery Learning combined with Jigsaw II	54,67	73,17	33,84	6,527
Discovery Learning	55,85	67,74	21,29	
Jigsaw II	60,18	70,04	16,38	
Conventional	54,65	64,49	18,00	

Table 4. Least Significance Difference Analysis of Discovery Learning combined with Jigsaw II, Discovery Learning, Jigsaw II, and Conventional Learning on Cognitive Learning Outcomes

Class	Pretest	Posttest	Corrected Average	LSD Notation
Discovery Learning combined with Jigsaw II	54,67	73,17	74,122	b
Discovery Learning	55,85	67,74	68,015	a b
Jigsaw II	60,18	70,04	67,824	a b
Conventional	54,65	64,49	65,461	a

2017). The expert group discussion also consists of discovery learning's syntax. Additionally, the stimulating activity becomes the initial activity to attract students to explore the introductory information given by teachers or they have gotten from their reading. The data collection becomes the second activity where students collect as much as information possible to answer the problem statement. The information may come from various sources such as literature reading, object observation, interviews, etc. The third activity is data processing. This activity allows students to process and tabulate the information in order to obtain new knowledge. The fourth activity is verification. This activity is used to check if the problem statement or hypothesis has been proven or not. The reevaluation process is done through the example students face daily. The fourth activity is a generalization, where students draw a conclusion serving as a general principle for other similar problems (Hosnan, 2014). The members of the expert group record every point being discussed as their base to explain again to their initial group (Slavin, 2010). The activity of recording becomes essential since it allows every member of the expert group to understand the required information which has come from various sources. This activity also aims to let every member of the group evaluate and access their required information (Kovalik, Yutzey, & Piazza, 2013). The next activity is the group report. Students get back to their initial group and act as a good teacher as well as listener in order to explain their topic and listen to the other topics (Slavin, 2010).

On the discovery learning model, the average score recorded was 82,603. Based on that score, the LSD notations show that this learning model is significantly different from the discovery learning model integrated with Jigsaw II. The learning discovery syntaxes that affect information literacy are data collection, data processing, and verification. The data collection activity is done through various ways such as reading related literature, direct observation, and self-trial. These various ways to collect data allows students to obtain many kinds of information, the good and not-really good ones.

Consequently, students have to know the way to identify and access the right, true and trusted information. The next activity is data processing. Students have to process, tabulate, and classify the information they have collected to find the essential information to answer the problem statement/hypothesis. This activity demonstrates the ways to evaluate information to the students. The last activity is verification. This

activity instructs students to re-evaluate if the processed information has answered the problem statement. Students can also relate the information to their daily life. In the end, this activity train students to use information in the right manner.

On the Jigsaw II learning model, the average score recorded was 84,236. Based on that score, the LSD notations show that this learning model is significantly different from discovery learning and discovery learning integrated with Jigsaw II. The Syntaxes from the Jigsaw II learning model that affect information literacy are reading and group reports. Reading is the initial activity completed by the students to gain introductory information or knowledge on every sub-topic. This activity is executed before the learning activity is started or students can do it in their homes. This activity train students to identify and access the required information during the teaching and learning process. The other activity is a group report. Students from the initial group explain and listen to each other information or new knowledge they have obtained in each sub-topic. This activity instructs students to legally and ethically use the information.

In the conventional learning model, the average score recorded was 79,008. This score was the lowest score from all of the learning model completed, regardless of the learning undergone by the students. The students' activity during the learning process is listening to teacher explanation and creating the big groups to explain the subtopic that have been assigned by teachers. Those two activities bring little improvement in students' information literacy since they are given all of the new pieces of information through teacher explanation and are not actively involved in the learning process. They are only actively involved when the teacher asks them to form the big group. However, that is not enough to develop students' information literacy since the big groups assigned by teachers consist of 8–10 students. Thus, some students do not contribute to solving the given task.

The Discovery Learning Model Combined with Jigsaw II to Improve Cognitive Learning Outcomes

This study also proves that the discovery learning model combined with Jigsaw II provides cognitive learning outcomes that are different from conventional learning as reported by Martaida, Bukit, and Ginting (2017), but not different from the discovery learning and Jigsaw II learning models. Significantly higher cog-

nitive learning outcomes compared to the other three learning models also prove that student academic outcomes will increase with the integration of Jigsaw II learning models with other learning models (Demir & Senemođlu, 2013).

The increase in cognitive learning outcomes is inseparable from the contribution of the syntax of the discovery learning model and Jigsaw II. The syntax of discovery learning combined Jigsaw II that influences cognitive learning outcomes, namely reading, expert group discussions (stimulation, problem statements, data collection, data processing, verification, and conclusions), and team reports.

The potential role of each syntax in improving learning outcomes in a comprehensive descriptive manner is as follows. (a) Reading; reading activities are carried out by students on all topics to find information and initial knowledge that are required during expert group discussions (Slavin, 2010). (b) Discussion of expert groups; in this activity, the teacher starts to provide some stimulation that make students confused and begin to find out about the information and students will make questions and hypotheses. The next step, students collect data from various sources thus they acquire more knowledge in accordance with their respective topics. Data and information that has been collected are then managed and tabulated and it further can be generalized and students acquire new concepts. Students then verify to re-check the hypothesis that has been proven or not by observing examples in the real life context. Furthermore, students draw conclusions as general principles that can be used on other similar problems (Hosnan, 2014). (c) Team report; students return to the home group and try to explain new knowledge/information and general principles to all group members and also try to be a good listener while other group members explaining (Slavin, 2010).

In the discovery learning model, the average value is corrected by 68.015. The corrected average value is higher than the class that runs the Jigsaw II learning model and conventional learning. Student cognitive learning outcomes are inseparable from the syntax of discovery learning models. The syntax of the discovery learning model is stimulation, problem statement, data collection, data processing, data verification, and drawing conclusions. The syntaxes that influence student cognitive learning outcomes were data collection and data processing. Data collection activity improves students of cognitive learning outcomes since it enables students to obtain new information and knowledge. This new information and knowledge will improve the cognitive possessed by each student.

In the Jigsaw II learning model, the average value was corrected at 67.824. The average value is still higher than conventional learning, but lower than discovery learning and discovery learning models combined with Jigsaw II. Student cognitive learning outcomes are inseparable from the syntax contribution of Jigsaw II learning models. The syntax of the Jigsaw II learning model is reading, expert group discussions, team reports, tests, and team recognition. The syntaxes that influence students' cognitive learning outcomes were reading and team reports. Reading activities improve student cognitive learning outcomes since it enables students to include information from the read material and literature. The next activity is the team report. This activity is influential since it enables students to acquire additional in-depth information than what was previously read.

In conventional learning, the average value was corrected by 65.461. This value is the lowest value of all learning models undertaken. This is inseparable from the learning activities carried out by students. Activities carried out by students during the learning process are listening to the teacher's explanation and creating a large group to explain the sub-topics that have been shared by the teacher. Both of these activities quite inhibit the increase in students' cognitive learning outcomes because the information obtained by students only comes from the teacher or a mandatory textbook that students must have. In addition, students who are less active in learning are also a problem. This discouraged students to learn thus the teacher's explanation was not understood by students.

CONCLUSION

Based on the results of the study, the discovery learning model combined with Jigsaw II significantly increases information literacy higher than other learning models and discovery learning models without being combined with other learning models. This combination learning model also significantly improves cognitive learning outcomes and it is higher compared to conventional learning models.

REFERENCES

- Al-Salkhi, M. J. (2015). The effectiveness of jigsaw strategy on the achievement and learning motivation of the 7th primary grade students in the islamic education. *International Journal Of Humanities and Social Science*, 5(4), 111–118.

- Anderson, & Krathwohl. (2001). *A taxonomy for learning, teaching, and assessing: A revision of bloom's taxonomy of educational objectives*. USA: Longman
- Anunobi, C. V., & Udem, O. K. (2014). Information Literacy Competencies: A Conceptual Analysis. *Journal of Applied Information Science and Technology*, 7(2).
- Averill, D., & Lewis, N. (2013). Students and information literacy: High school and postsecondary perspectives. *Maine Policy Review*, 22(1), 114–117.
- Aziz, R. A. (2017). *Mengembangkan keterampilan literasi informasi siswa melalui penerapan model pembelajaran discovery learning dalam pembelajaran IPS: Penelitian tindakan kelas pada siswa kelas VII-C SMPN 26 Bandung* (Unpublished doctoral dissertation). Universitas Pendidikan Indonesia, Indonesia.
- Demiri, K., & Senemoglu, N. (2017). Integrated curriculum, cooperative (Jigsaw II) and project based learning applications. *International Journal of Scientific Research in Education*, 10(4), 413–424.
- Eisenberg, M. B. (2008). Information literacy: Essential skills for the information age. *DESIDOC Journal of Library & Information Technology*, 28(2), 39–47.
- Fidanata, M. (2017). *Penerapan metode pembelajaran discovery learning dengan setting kooperatif tipe jigsaw untuk meningkatkan hasil belajar siswa materi barisan dan deret kelas XI SMK PGRI 1 Tulungagung* (Unpublished undergraduate thesis). IAIN Tulungagung, Indonesia.
- Gurria, A. (2015). *PISA result in focus*. Retrieved from <https://www.oecd.org/pisa/pisa-2015-results-in-focus.pdf>.
- Hisle, D., & Webb, K. (2017). *Information literacy concepts: An open educational resource*. Greenville: Joyner Library.
- Hosnan, M. (2014). *Pendekatan saintifik dan kontekstual dalam pembelajaran abad 21: Kunci sukses implementasi kurikulum 2013*. Jakarta: Ghalia Indonesia.
- Kemendikbud. (2016). *Gerakan literasi untuk tumbuhkan budaya literasi*. Jakarta: Biro Komunikasi dan Layanan Masyarakat (BKLM).
- Klefstad, B., Maribu, G., Horgen, S. A., & Hjeltnes, T. (2010, November). Learning outcomes and a taxonomy as a starting point for creating digital multiple-choice tests. In *Seminar. net*, 6(3).
- Kovalik, C., Yutzy, S., & Piazza, L. (2013). Information literacy and high school seniors: Perceptions of the research process. *School Library Research*, 16, 1–26.
- Learning, C. (2015). *P21 Framework Definitions*. Retrieved from http://www.p21.org/storage/documents/docs/P21_Framework_Definitions_New_Logo_2015.pdf.
- Martaida, T., Bukit, N., & Ginting, E. M. (2017). The effect of discovery learning model on student's critical thinking and cognitive ability in junior high school. *IOSR Journal of Research & Method in Education (IOSR-JRME)*, 7(6), 1–8.
- Murti, D. P., & Winoto, Y. (2018). Hubungan antara kemampuan literasi informasi dengan prestasi belajar siswa SMAN 1 Cibinong kabupaten Bogor. *BIBLIOTIKA: Jurnal Kajian Perpustakaan dan Informasi*, 2(1), 1–5.
- Omeluzor, S., & Bamidele, I. (2013). Information literacy skills among postgraduate students of Babcock university, Nigeria. *International Journal of Innovative Research in Management*, 12(2), 1–18.
- Badan Standar Nasional Pendidikan. (2010). *Laporan BSNP 2010*. Retrieved from <http://www.bsnp-indonesia.org/id/wp-content/uploads/2012/04/Laporan-BSNP-2010.pdf>.
- Potter, M. K., & Kustra, E. (2012). A primer on learning outcomes and the SOLO taxonomy. *Course Design for Constructive Alignment*, (Winter 2012), 1–22.
- Slavin, R. E. (2010). *Cooperative learning*. London: Allyn and Bacon.
- Sönmez, V. (2017). Association of cognitive, affective, psychomotor and intuitive domains in education, sönmez model. *Universal Journal of Educational Research*, 5(3), 347–356. <https://doi.org/10.13189/ujer.2017.050307>.
- Syah, M. (2014). *Psikologi pendidikan*. Bandung: PT Remaja Rosdakarya Offset.
- Widodo, Sujadi, I., & Riyadi. (2015). Eksperimentasi model pembelajaran kooperatif tipe Jigsaw dengan guided discovery learning pada materi bangun ruang sisi datar ditinjau dari locus of control. *Jurnal Elektronik Pembelajaran Matematika*, 3(3), 268–280.
- Yu, H., Abrizah, A., & Sani, M. K. J. A. (2016). Information literacy through resource-based learning: Malaysian teachers' conception and instructional practices. *Malaysian Journal of Library & Information Science*, 21(1), 53–67.