Proceeding Biology Education Conference p-ISSN:2528-5742
Vol. 17, No.1
Page:28-34 July2021

The Relationship Between Learning Styles with Learning Outcome and Scientific Literacy of Islamic Junior High School (MTs) Students in Mataram

Gito Hadiprayitno[1, 2, a)] A Wahab Jufri[1, 2], and Siti Syifa'un Nufus[2, b)]

[1]*Biology Education Study Program, Universitas Mataram, Indonesia.*
[2]*Magister of Science Education Study Program, Universitas Mataram, Indonesia*

[a)]*Corresponding author: gitohadiprayitno@unram.ac.id*
[b)]*sitisyifa.azzahra@gmail.com*

Abstract. Learning style is one of the important elements in the learning process of students. Information about student learning styles will help teachers design appropriate learning so that students can more easily absorb, organize, and process information during the learning process. Learning following the character of students in the class will create joyful learning and influences student learning outcomes and abilities, including scientific literacy. This study aims to investigate the relationship between learning styles with student learning outcomes and scientific literacy. This research is descriptive survey research. This research was conducted at MTsN 1 Mataram and MTsN 2 Mataram. The research sample was 55 MTs students in Mataram who were selected non-randomly. The variables measured were learning styles, scientific literacy skills, and science learning outcomes. Learning styles in this study consist of visual, auditory, read/write, and kinesthetic (VARK). Learning styles were measured using the VARK questionnaire which was adapted from Neil D. Fleming's version 8.01 questionnaire which can be accessed through the VARK website. Scientific literacy in this research includes indicators (a) explaining phenomena scientifically, (b) assessing and designing scientific investigations, and (c) interpreting data and evaluating scientific evidence. Science literacy data were collected using a scientific literacy test consists of 40 multiple-choice questions that spread evenly on each indicator. The test instrument used in this study has gone through a validation process by experts. The collection of data on learning styles and scientific literacy carried out online using the Google Form by asking respondents to fill out a learning style questionnaire and to answer questions on the science literacy test. Science learning outcomes data obtained from the even semester science final exam scores. Analysis of the relationship between learning styles and scientific literacy used bivariate correlation, while the analysis of the effect of learning styles on learning outcomes and scientific literacy used ANACOVA. The results of the study indicated that the trend of auditory and kinesthetic learning styles correlated significantly with students' scientific literacy ($p < 0.05$), whereas visual and reading/writing learning styles did not significantly correlate ($p > 0.05$). The type of learning styles does not have a different effect on student learning outcomes and scientific literacy, but scientific literacy has a significant influence on learning outcomes ($p < 0.05$).

Keywords: *Learning style, learning outcome, scientific literacy*

INTRODUCTION

Learning style is one of the important elements in the learning process of students. Information about student learning styles will help teachers design appropriate learning so that students can more easily absorb, organize, and process information during the learning process. Learning style is defined as the most sensitive response in a person's brain to receive data or information from information givers and the information-giving environment [1]. Information will be accepted by the brain more quickly if it is following the learning style [2]. The particular system

about an individual's learning preference is known as VARK (visual, auditory, reading/writing, and kinesthetic) popularized by Fleming [3].

There are many models and theories about learning styles. Each individual has a preferred learning style. One particular style is not better than the others and a preferred style does not mean someone cannot learn in other ways, it is simply what may work best to process, learn, and retain information [4]. Students may become better learners if they know their learning styles and use their respective strategies. Learning following the character of students in the class will create joyful learning and influence student learning achievement and abilities, including scientific literacy.

Scientific literacy has been defined in multiple ways, all of which emphasize students' abilities to make use of scientific knowledge in real-world situations [5]. In PISA 2006, it was defined as: "… the capacity to use scientific knowledge or information, to identify questions and to create evidence-based conclusions to understand and help make decisions or actions about the natural world and the changes made to it through human activity." [6]. Then, in PISA 2009, scientific literacy is defined as the skill to engage with science-related issues, and with the topic of science, as a reflective person [7].

Currently, scientific literacy is interpreted as the skill to read and comprehend science-related issues and also as the ability to understand scientific processes, to apply scientific principles, and to engage meaningfully with scientific information available in daily life [8]. Individuals use scientific information in many real-world conditions beyond the classroom, in ways ranging from evaluating sources of evidence used in media reports about science to recognize the role and value of science in society to interpreting quantitative information and performing quantitative activities.

Achieving scientific literacy has been proposed as the main goal of science education in many countries [9], as one of the most important skills needed by all young generations in the 21st century [10], [11]. According to [12] reason that higher levels of scientific literacy would tend to increase support for science and provide the public with a more realistic expectation of science education. Some characteristics of a scientifically literate person include: (a) describe phenomena scientifically, (b) evaluate and create scientific inquiry, and (c) interpret data and evidence scientifically [13], [14].

There has been considerable government will and policy attention to increasing the quality of education. Scientific literacy has become one of the main objective parts of elementary and secondary education in Indonesia and also is one of the strategic ways to help students achieve optimum learning outcomes [15]. Based on the description above, the purpose of this study is to investigate the relationship between learning styles with student learning outcomes and scientific literacy.

METHOD

This research is descriptive survey research. This research was conducted at MTsN 1 Mataram and MTsN 2 Mataram. The research sample was 55 MTs students in Mataram who were selected non-randomly. The variables measured were learning styles, scientific literacy skills, and science learning outcomes. Learning styles in this study consist of visual, auditory, read/write, and kinesthetic (VARK). Learning styles were measured using the VARK questionnaire which was adapted from Neil D. Fleming's version 8.01 questionnaire which can be accessed through the VARK website. Scientific literacy in this research includes indicators (a) explaining phenomena scientifically, (b) assessing and designing scientific investigations, and (c) interpreting data and evaluating scientific evidence. Science literacy data were collected using a scientific literacy test consists of 40 multiple-choice questions that spread evenly on each indicator. The test instrument used in this study has gone through a validation process by experts. The collection of data on learning styles and scientific literacy carried out online using the Google Form by asking respondents to fill out a learning style questionnaire and to answer questions on the science literacy test. Science learning outcomes data obtained from the even semester science final exam scores. Analysis of the relationship between learning styles and scientific literacy used bivariate correlation, while the analysis of the effect of learning styles on learning outcomes and scientific literacy used ANACOVA.

RESULT AND DISCUSSION

The Relationship Between Learning Style Preferences and Students' Scientific Literacy Skills

Information about the tendency in student learning styles needs to be known by the teacher to design joyful learning according to student needs [16]. Interesting and joyful learning will have a positive impact on learning enthusiasm and learning achievement. The VARK questionnaire that has been developed is used to collect data on student learning styles. There are 4 preferences in student learning styles analyzed in this study, namely visual, auditory, reading/writing, and kinesthetic. The results showed that most of the research subjects easily obtained and processed information with a hands-on approach (47,2%). Besides, 23,6% of students easily obtained and processed information using a verbal approach. Students who tend to learn in a visual style and read/write are 14,6% of students.

Visual learners need to see the teacher's body language and facial expression to fully understand the content of a lesson. They generally prefer to sit at the front of the classroom. These individuals think in pictures and may learn best from visual displays including diagrams, illustrated textbooks, overhead transparencies, videos, flipcharts, use of interactive whiteboards, and handouts. During a lesson or classroom discussions, visual learners often prefer to take detailed notes to absorb the information [3], [17].

Auditory individuals learn best through verbal lessons, discussions, talking things through, and listening to what others have to say. Auditory learners interpret the underlying meanings of speech through listening to the voice tone, pitch, and speed. These learners often benefit from reading the text and notes out loud and/or listening to recorded notes and information from texts [3], [17], [18]. Individuals with reading/write preferences prefer information displayed as words. Emphasis is placed on text-based input and output, i.e. reading and writing in all its forms. People who prefer this modality love to work using PowerPoint, the internet, lists, dictionaries, thesauri, and words [3], [18]. The last one, kinesthetic learners, learn best through a hands-learning preference to sit still for long periods. Kinesthetic learners can become distracted by their need for movement and activity [3], [17], [18].

Data on students' scientific literacy were obtained using a science literacy test instrument with a total of 40 scientific literacy questions in the form of multiple-choice, while the science learning outcomes were obtained from the final score of an even semester. The mapping of scientific literacy abilities and science learning outcomes according to the trends in student learning styles can be seen in the following table.

TABLE 1. Student' Score on The Scientific Literacy and Learning Achievement

Learning Style Preferences	N	Scientific Literacy Average Score	Learning Achievement Score
Visual	8	38,75	65,62
Auditory	13	45,57	67,69
Read/Write	8	45,62	65,00
Kinesthetic	26	48,46	68,65

These data indicate that students' scientific literacy skills are still low. One of the tests that measure students' scientific literacy is the PISA (Program for International Students Assessment). In 2009, Indonesia was ranked 61st out of 66 countries with an average score of 383 [19]. In 2012, Indonesia's ranking was in 64th position out of 65 with an average score of 382 [20] and on the 2015 PISA test [21] Indonesian students were ranked 63rd out of 72 countries with an average score of 403. The latest result of PISA in 2018, Indonesia's position declined to position 71 out of 77 countries that took the test with an average score of 382 [22].

The correlation or relationship test was carried out on the learning style preferences (LSP) variable with the students' scientific literacy (SL). A correlation test was carried out on each of the learning style preferences towards students' scientific literacy abilities. The results of the correlation test can be seen in the following tables.

TABLE 2. Correlation Test Results. (a) Correlation of Visual LSP with SL; (b) Correlation between Auditory LSP and SL; (c) Correlation of Reading/Writing LSP with SL; and (d) Correlation between Kinesthetic LSP and SL.

		LSP (Visual)	SL
LSP (Visual)	Pearson Correlation	1	.455
	Sig. (2-tailed)		.258
	N	8	8
SL	Pearson Correlation	.455	1
	Sig. (2-tailed)	.258	
	N	8	8

(a)

		LSP (Auditory)	SL
LSP (Auditory)	Pearson Correlation	1	.729**
	Sig. (2-tailed)		.005
	N	13	13
SL	Pearson Correlation	.729**	1
	Sig. (2-tailed)	.005	
	N	13	13

**. Correlation is significant at the 0.01 level (2-tailed).

(b)

		LSP (Read/Write)	SL
LSP (Read/Write)	Pearson Correlation	1	.692
	Sig. (2-tailed)		.057
	N	8	8
SL	Pearson Correlation	.692	1
	Sig. (2-tailed)	.057	
	N	8	8

(c)

		LSP (Kinesthetic)	SL
LSP (Kinesthetic)	Pearson Correlation	1	.503**
	Sig. (2-tailed)		.009
	N	26	26
SL	Pearson Correlation	.503**	1
	Sig. (2-tailed)	.009	
	N	26	26

**. Correlation is significant at the 0.01 level (2-tailed).

(d)

From Table 2 above, it can be seen that the preference for auditory and kinesthetic learning styles has a significant correlation with students' scientific literacy skills ($p < 0.05$), while the preference for visual learning styles and reading/writing is not significantly correlated ($p > 0.05$). This is possible because the learning process in the classroom that has been carried out is mostly using lecture (auditory) and practicum (kinesthetic) methods, and also students have not fully recognized their specific learning styles. This was also conveyed by [23], [24], [31]. This is in line with the opinion of [29] that students with kinesthetic learning styles tend to be more active, expressive, and enthusiastic in doing something. It can be said that when students gain an understanding of concepts and can implement them through scientific studies, then indirectly the students slowly practice their scientific literacy skills [32]. In this case, the ability to evaluate and design scientific investigations was previously strongly supported by the ability to explain phenomena scientifically [22]. Thus, to maximize efforts to improve scientific literacy skills, teachers can choose learning methods by combining the needs of different student learning styles.

There are several studies related to learning styles that show varied results [33], [34], [35], [36]. This shows that research on learning styles is dynamic and not absolute. Research conducted by [33] shows that in online learning, students who are dominant in visual learning styles and reading/writing have a positive effect on the learning process, while research conducted by [40] shows that students are more dominant with kinesthetic and visual learning styles. However, students with kinesthetic learning style preferences have a positive effect on student learning outcomes, while visual learning styles tend to not. Another study conducted by [35] showed that the study sample was more dominant to be visual and auditory. The kinesthetic and read/write learning style preferences did not have a significant effect. Other research [36] showed that the study sample was more dominant in visual and

read/write, but students with auditory learning style preference had better learning outcomes. This provides an opportunity to conduct other research to determine good learning methods, which can accommodate student learning style preferences in class.

The Effect of Learning Style Preferences on Student Learning Outcomes and Scientific Literacy Skills

The results showed that there was a significant positive relationship between learning styles (auditory and kinesthetic) and scientific literacy skills. So that further analysis is needed using the Manova test to determine the effect of these learning styles on student learning outcomes and scientific literacy abilities.

TABLE 3. Manova Test Results. (a) Effect of LSP on LO and (b) Effect of LSP on LS

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	113.108	3	37.703	.324	.808
Within Groups	5930.529	51	116.285		
Total	6043.636	54			

(a)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	581.377	3	193.792	1.305	.283
Within Groups	7574.760	51	148.525		
Total	8156.136	54			

(b)

From Table 3 it can be seen that the preference of learning styles has no effect on learning outcomes and scientific literacy ($\alpha = 0.05$, sig = 0.808 and $\alpha = 0.05$, sig = 0.283). This means that one particular learning style tendency is not better than other learning styles. Each student has learning style preferences that help them to process, study, and store information [3], [18]. Students can become better learners if they know their learning style trends and use their respective strategies [25]. A learning style is something that students have individually in accepting and understanding a concept, as well as teachers with their respective teaching styles [30], [31]. The good of student learning styles can be used as a material consideration for teachers to determine appropriate learning strategies in instilling important concepts in the students' minds. This result is not following several previous studies which prove that learning styles affect student learning outcomes [26], [27], [28].

CONCLUSION

The trend of auditory and kinesthetic learning styles correlated significantly with students' scientific literacy, whereas visual and reading/writing learning styles did not significantly correlate. The type of learning styles does not have a different effect on student learning outcomes and scientific literacy, but scientific literacy has a significant influence on learning outcomes. Recommendations that can be given for further research are to determine the appropriate and effective learning models to improve students 'scientific literacy because in this study it was found that students' scientific literacy was quite low.

ACKNOWLEDGMENTS

The researcher appreciates thanks to the Ministry of Education and Culture for providing funding and assistance for researchers during the study. Researchers also want to express their thanks and appreciation to all parties, who have provided assistance ranging from the development, testing, and publication of this research.

REFERENCES

1. Shah, K., Junaid, A., Nandita, S., Srikant, N. 2013. How different are students and their learning styles?. International Journal of Research in Medical Sciences 1 (1):2320 – 2340.
2. Baykan, Z., Nacar, M. 2007. Learning styles of first-year dental students attending Erciyes University in Kayseri, Turkey. Adv Physiol Edu 31 (1): 58 – 68.

3. Fleming, N. D. 1995. I'm different; not dumb. Modes of presentation (VARK) in the tertiary classroom, in Zelmer, A., (ed.) Research and Development in Higher Education, Proceedings of the 1995 Annual Conference of the Higher Education and Research Development Society of Australasia (HERDSA). HERDSA Volume 18, pp. 308 – 313.
4. Alice, Y., Kolb, A., David, A. 2005. Learning Styles and Learning Spaces: Enhancing Experiential Learning in Higher Education. AMLE, 4, 193–212, https://doi.org/10.5465/amle.2005.17268566
5. American Association for the Advancement of Science (AAAS). 1990. Science for All Americans, New York: Oxford University Press.
6. Organization for Economic Co-operation and Development. 2006. The PISA 2006 Assessment Framework—Mathematics, Reading, Science and Problem Solving, Knowledge, and Skills.
7. OECD "Science Sample Tasks", in Take the Test: Sample Questions from OECD's PISA Assesments. 2009. OECD Publishing, http://dx.doi.org/10.1787/978264050815-5/Retrived, 10August 2020.
8. Fives, H. R., Huebner, W., Birnbaum, A. S., Nicolich, M. 2014. Developing a Measure of Scientific Literacy for Middle School Students" Science Education, 98 (4), 549 - 580.
9. Wenning, C. J. 2009. Assessing nature-of-science literacy as one component of scientific literacy. J. Phys. Tchr. Educ. Online, 3 (4).
10. Saavedra, A. R and Opfer, V. D. 2012. Teaching and Learning 21st Century Skills: Lessons from the Learning Sciences. Asia Society, Partnership for Global Learning.
11. Hiong, L. C and Osman, K. 2013. A Conceptual Framework for the Integration of 21st Century Skills in Biology Education Research. Journal of Applied Sciences, Engineering and Technology 6 (16), pp.2976-2983. http://www. maxwellsci.com/ print/rjaset/v6-2976-2983.pdf. Retrived, 10August 2020.
12. Laugksch, Rüdiger, C. 2000. Scientific Literacy: A Conceptual Overview. Science Education. https://www. researchgate.net/publication/200772545/Retrived: 12August 2020.
13. Gormally, C., Brickman, P., Lutz, M. 2012. Developing a Test of Scientific Literacy Skills (TOSLS): Measuring Undergraduates' Evaluation of Scientific Information and Arguments. CBE—Life Sciences Education. 11, 364–377.
14. OECD. 2016. Education at a Glance 2016: OECD Indicators, OECD Publishing, Paris: http://dx.doi.org/10.187/eag-2016-en/Retrieved: 11August 2020.
15. Okada, A. 2014. Scientific Literacy in the Digital age: Tools, Environments and Resources for Co-inquiry. European Scientific Journal. Special edition 4, 1857 – 7881.
16. Chatib, M. 2016. Gurunya Manusia: menjadikan Semua Anak Istimewa dan Semua Anak Juara. Bandung: Mizan Pustaka.
17. Chatib, M. 2019. Semua Anak bintang: menggali Kecerdasan dan Bakat Terpendam dengan Multiple Intelligences Research (MIR). Bandung: Mizan Pustaka.
18. Kanchi, S., Junaid, A., Nandita, S., Srikant, N. 2013. How different are students and their learning styles?. International Journal of Research in Medical Sciences 1 (1): 350 – 361.
19. OECD. 2009. Results: What Students Know and Can Do Student Performance in Reading, Mathematics and Science. Downloaded from http://www.oecd.org/pisa/ 2548. pdfpisaproducts/4885. Retrived, 10August 2020.
20. OECD. 2012. PISA 2012 Results in Focus. What 15-year-olds Know and What They Can Do with What They Know. Downloaded from www.oecd.org/pisa/.../pisa-2012-results.htm.Retrived, 10August 2020.
21. OECD. 2015. PISA 2015 Results Excellence and Equity in Education, OECD Publishing, Paris. Vol.I. Downloaded from http://dx.doi.org/10.1787/ 9789264266490-en. Retrived, 10August 2020.
22. OECD. 2019. PISA 2018 Assessment and Analytical Framework, PISA, OECD Publishing, Paris. Volume I. Downloaded from https://doi.org/10.1787/7fda7869-en. Retrived, 10August 2020.
23. Chatib, M. 2015. Kelasnya Manusia: Memaksimalkan Fungsi Otak belajar Dengan Manajemen Display Kelas. Bandung: Mizan Pustaka.
24. Yaumi, M. 2012. Pembelajaran Berbasis Multiple Intelligences. Jakarta: Dian Rakyat.
25. DePorter, B., Hernacki, M. 2013. Quantum Learning Membiasakan Belajar Nyaman dan Menyenangkan. Bandung: Kaifa Learning.
26. Gunawan, Harjono, A., Imran. 2016. Pengaruh Multimedia Interaktif dan Gaya Belajar Terhadap Penguasaan Konsep Kalor Siswa. Jurnal Pendidikan Fisika Indonesia 12 (2) 118-125DOI: 10.15294/jpfi.v12i2.5018.
27. Khoeron, I. R., Sumarna, N., Permana, T. 2014. Pengaruh gaya Belajar Terhadap Prestasi Belajar Peserta Didik Pada Mata Pelajaran Produktif. Journal of Mechanical Engineering Education,1 (2): 291 – 297.
28. Soylu, M. Y. 2009. The Effect of Learning Style on Achievement in Different Learning Environments. The Turkish Online Journal of Educational Technology 8 (4) pg. 43 – 50.

29. Taiyeb, A. M., Mukhlisa, N. 2015. Hubungan Gaya Belajar dan Motivasi Belajar dengan Hasil Belajar Biologi Siswa Kelas XI IPA SMA Negeri 1 Tanete Rilau. Bionature 16 (1): 29 – 38.
30. Syofyan, H. 2018. Analisis gaya belajar dan motivasi berprestasi terhadap hasil belajar IPA. Jurnal Eduscience 3 (2): 76 – 85.
31. Nurlia, N., Hala, Y., Muchtar, R., Jumadi, O and Taiyeb, M. 2017. Hubungan antara gaya belajar, kemandirian belajar, dan minat belajar dengan hasil belajar biologi siswa. Jurnal Pendidikan Biologi 6 (2): 321 – 328.
32. Pertiwi, U. D., Atanti, R. D. and Ismawati, R. 2018. Pentingnya Literasi Sains Pada Pembelajaran IPA SMP abad 21. Indonesian Journal of Natural Science Education (IJNSE) 1 (1): 24 – 29.
33. Drago, W. A and Wagner, R. J. 2004. VARK preferred learning styles and online education. Management Research News, 27 (7): 1-13. https://doi.org/10.1108/01409170410784211.
34. Vaishnav, R. S. 2013. Learning Styles and Academic Achievement of Secondary School Students. Voice of Research 1 (4): 97 – 104.
35. Ibrahim, R. H and Hussein, D. 2016. Assessment of Visual, Auditory, and Kinesthetic Learning Style Among Undergraduate Nursing Students. International Journal of Advanced nursing Studies 5 (1): 1 – 4.
36. Dobson, J. L. 2009. Learning Style Preferences and Course Performance in an Undergraduate Physiology Class. Advances Physiology Education 308–314; doi:10.1152/advan.00048.2009.