Scientiae Educatia: Jurnal Pendidikan Sains (2019), Vol 8(1): 23-35
DOI: http://dx.doi.org/10.24235/sc.educatia.v8i1.4099
Published by Tadris IPA Biologi, IAIN Syekh Nurjati Cirebon, Indonesia. p-ISSN: 2303-1530, e-ISSN: 2527-7596

SCIENTIAE EDUCATIA: JURNAL PENDIDIKAN SAINS

journal homepage: www.syekhnurjati.ac.id/jurnal/index.php/sceducatia

http://www.syekhnurjati.ac.id/jurnal/index.php/sceducatia/article/view/4099

The Effectiveness of Inquiry-Based Science Web-Module on the Students' Thinking Skills and Positive Attitudes Towards Science

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a r t i c l e i n f o

Article history:
Received: 14 March 2019
Received in revised form: 04 April 2019
Accepted: 23 May 2019
Available online: 24 June 2019

Keywords:
Science web-module
Thinking skills
Positive attitude towards Science
Dieng Mountains ecosystem

a b s t r a c t

In the 21st century and the industrial revolution era 4.0, students are required to have thinking skills to solve problems around them by utilizing available information. But in Science learning, the material raised is not from the environment around the students. For example, in the material of organism or living things interaction, the ecosystem discussed is outside Indonesia, besides Indonesia has 47 types of ecosystem. One of them is Dieng. Less contextual Science material causes poor of students positive attitude towards Science. Thus, the purpose of this study is to identify the effect of using the Science module web on thinking skills and positive attitude towards Science. This study was a quasi-experimental study with class 7C and class 7D in SMP N 1 Wonosobo as subjects. Data collection technique used question and questionnaire. Data were processed using the Kruskal Wallis test, and it was found that the effect was largely using the effect size. The result of the study shows that there are differences in thinking skill and positive attitude towards Science between the experimental and control classes. The web-module science has a significant effect on thinking skill with effect size large of 0,9 and moderate effect on positive attitude towards science with an effect size of 0,7.

1. Introduction

Recently, education has the task of preparing students to face changes and challenges in the industrial era 4.0 and life in the 21st century. Future life that students faced requires students to be able to coexistence or mutualism and take advantage of existing technological advances. To prepare for all the challenges that students must face in the 21st century, Partnership for 21st Century Learning (P21) formulates a 21st-century learning framework developed based on input from teachers and education experts. 21st-century skills consist of life and career skill, learning and innovation skills, information, media, and technology skills.

Fifty years ago students only needed to master three RS (reading, writing and arithmetic), but now entering the industrial era 4.0 with the disclosure and speed of information changes, it is no longer enough. When students become part of the life of this era, students need to have the ability to learn and innovate learning and innovation skill that is included in 21st century skills needed. These are also needed to face the industrial era 4.0 (National Education Association, 2012).

Data on internet world usage states that information access and active internet users throughout the world have 200 times increased since the beginning of the internet released in 1995. The latest data taken in December 2017 states that four billion people are active internet users, and 49.2% of internet users comes from Asia. The Indonesian internet service providers association said that at the end of 2016, 132.7 million Indonesian people were active internet users, or represented more than half of Indonesia's population, and 90% of users were students. Another surprising thing is that 100% of the age group 10 to 14 years are in the age range of junior high school students. They actively use the internet and social media without knowing how to process and sort the right and reliable information.

In the current era of information disclosure, the internet is one of the media to disseminate information, but not all information spread the internet can be justified. Data reported by CNN Indonesia, at the end of 2016, The Minister of Communication and Informatics stated that there were 700-800 thousand sites that spread irresponsible inform the number of irresponsible information disseminating sites related to things that are significant and it causes negative things. Therefore, appropriate action is needed from the school, especially the teacher, so students can process, sort, or criticize information before sending usable information to fix problems in the surrounding environment. Those actions are aimed to have thinking skills. Thinking skill is the tool that helps students deepen their understanding to implement ideas and produce possibilities with the presence of advanced technology to access, find information, analyze, store, manage information to support critical thinking and problem solving of students (Carol, et al., 2015).

Students who have thinking skill are characterized by being able to understand information; use thinking ability; formulate an alternative solution; and solve the problem. (Trilling & Fadel, 2009; Selcuk, Caliskan & Erol, 2008; Miri, Daviid & Uri, 2007; Nugraha, Suyitno & Sisilaningsih, 2017). Students who can think, can make the right decision by utilizing the sources of information around them (Gardner, 2014). Thinking skill is not only needed to make the students capable to choose and process reliable information amid the fast flow of information, but also can make students able to take advantage of this flow of information to overcome problems in their surrounding environment. Thinking skills can be trained through one of the learning activities through science learning.

Science subject can be used to implement thinking skill because Science is not only oriented to academic competencies but also makes students competent to understand nature and all its symptoms and implement what has been learned in daily life (Muzakir, 2012). On the other hand, Science learning carried out by teacher in school is not in accordance with daily life experienced by

students or less contextual. It can be seen from the content of Science textbook that is not contextual, one of which is the sub-material interaction between living things and the environment stated in the Basic Competence 3.7 of seventh grade.

In the sub-material, there are no examples of ecosystems that are close to students or ecosystems which available in Indonesia. The Indonesian Research Institute (2010) stated that Indonesia is one of the mega biodiversity countries with a degree of ecological uniqueness, and that diversity of organisms are represented organisms on Earth. Ecology experts stated that Indonesia has 47 types of a natural ecosystem that make Indonesia as a country with a complete ecosystem (Supriatna, 2008) so that this ecosystem wealth is a particular potential thing to be purposed in learning activities. One of the high diversity ecosystems that can be discussed in this study is the Dieng Mountains Ecosystem.

Research conducted by Nijman (2000) stated that Dieng has the only mountainous natural forest left in Central Java Province with an area of 255 km^2 and is a sanctuary for endemic species in Central Java, so that the ecosystem in the Dieng Mountains has the potential to be taught in basic competence 3.7 of seventh grade about the interaction of organism and their environment. However, most of the examples presented and reviewed are ecosystems that are outside the country of Indonesia, making the science material seems abstract and out of the daily lives context of students.

Osman, Iksan, and Halim (2007) stated that Science materials that are considered abstract or irrelevant to students' lives make students perceive negative about Science. This is proven from the result of the questionnaire filling in the positive attitude of students towards science before the implementation of learning using the Science web module. Based on the score of the questionnaire of positive attitude towards Science, it is known that students are not interested in science learning at school, do not understand about the investigation process to find ideas in Science, are not interested in science activities in everyday life, and not interested in developing their talent in Science in their future there are two groups of factors that influence students' attitudes towards science, namely exogenous factors (factor originating outside the educational process) and endogenous (factor originating in the education process and under the supervision of the implementers of the educational process such as teacher, parent, principal) (Stern, Kalof, Dietz, & Guagnano, 2012), so that teachers have a role in making students positive about learning and Science materials they learned.

Thinking skill and positive attitude of students in Science can be improved through learning activities with certain methods. A learning method that can be used to support 21st-century learning

is the inquiry method. An inquiry is not merely about answering questions to get the right answers, but rather investigating, exploring, searching, investigating activities and research (Kuhlthau, Maniotes, & Caspari, 2007). Meanwhile, the result of the interview with Science teachers found the fact that the teacher does not carry out learning too often with the inquiry method due to the time limitedness. This causes students to be unfamiliar with conducting investigative activities and using deepen thinking skill while learning. Though, Maisah, Marjono and Arianto (2017) states in their research that the Guided Inquiry Learning model can improve thinking skill by 17.66% because the implementation of learning using the Guided Inquiry can train the components of thinking skill. The next study was conducted by Aktamiş, Hiğde, and Özden (2016) stating that the guided inquiry learning method was effective for increasing the positive attitude of students in Science so that the researcher chose the guided inquiry method as a learning method in this study.

Beside requiring learning methods, the learning process implementation also requires learning tools used to help teacher achieve 21st-century learning goals and demands for students who will live in the industrial era 4.0. In the upcoming 21st century, education is in the era of knowledge with an increasing extraordinary knowledge due to the use of media digital technology (information super highway), Therefore, teaching material must be in accordance with the needs of knowledge age, namely contextual teaching material to enable students to collaborate in solving problem using available information technology resources (Wijaya, Sudjimat & Nyoto, 2016). In addition, to preparing students to enter the industrial era, 4.0 learning must be integrated with internet technology such as using website-based learning or application use in learning. However, based on the results of observation and interviews with teachers, the teaching materials used to carry out the learning activities are science printed books and summary of materials from the Science Teacher Professional Development Forum. Printed teaching material is less effective in learning activities because the information contained in printed teaching material is limited only to information that has been written. Beside those printed teaching materials cannot be accessed freely, only students who have the book who can use it. On the other hand, 21st-century learning requires teaching materials that facilitate students to use available information technology resources and can freely access without limitation of space and time. Jas (2012) stated that learning using a website has an interactive characteristic because the website provides extensive access to information by combining the content on the website with other information sources on the internet. Besides, the web module can load interesting media to students, such as video, animation, or music.

Based on the description of the problem and the solution offered, the application of guided inquiry-based science web-modules integrated with the local potential of the Dieng Mountains Ecosystem is expected to be effective to improve thinking skills and positive attitudes towards Science. The objectives of this study are: (1) to find out the impact of using guided inquiry-based Science web-module integrated the local potential of the Dieng Mountains Ecosystem towards student thinking skills; and (2) to identify the effect of using guided inquiry-based Science web-module integrated the local potential of the Dieng Mountains Ecosystem towards students' positive attitudes toward science.

2. Research Methodology

2.1 Types and Design of the Research

This research is a quasi-experimental research with post-test control group research design. Post-test control group design according to Creswell (2012) is shown in Table 1.

Table 1. Postest control grup design

Group	Treatmen	Post-test
Control class	X_a	O_2
Experimental class	X_b	O_2

Information:
X_a : the class which uses developing web module science.
X_b : the class which uses learning material commonly used by the teacher.
O_2 : post-test thinking skills and the questionnaire about students positive attitudes towards Science.

2.2 Sample and Population

The population of this study was 7th-grade students of SMP Negeri 1 Wonosobo. 256 students were divided into eight classes, namely 7A to 7H. The sample used were two classes. The sample was chosen using cluster random sampling technique where the first class was 7C as the experimental class and the second one was 7D as the control class.

2.3 Data Collection Techniques

Data collection techniques in this study are divided into two, namely test and non-test techniques. The test technique is used to collect thinking skills data with instruments in the form of post-test questions. The non-test technique was used to collect positive attitude data on science with instruments in the form of a positive attitude questionnaire towards science.

2.4 Statistical Analysis

Collected data on thinking skills and positive attitudes towards science will be processed using the K-Independent Sample Test or Kruskal Wallis Test with the assist of software SPSS 22. This test is used to see the differences between two variables (thinking skills and positive attitudes towards Science) in two sample classes (experimental class and control class). Furthermore, this test is to identify the magnitude of the Natural Science Web-Module effect on thinking skills and the positive attitude towards food science; effect size calculation was carried out using the following formula.

$$d = \frac{M_1 - M_2}{\alpha \text{ polled}}$$

Information:

d = Cohen's d effect size
M_1 = Averages of Experimental Class
M_2 = Averages of Control Class
α polled = Standard Deviation

After getting the effect size calculation, then compare the results with the table below.

Table 2. Result criteria of effect size

Nilai Effect Size	Keterangan
$d \leq 0{,}2$	Low Influence
$0{,}2 \leq d \leq 0{,}8$	Moderate Influence
$d \geq 0{,}8$	High Influence

3. Result and Discussion

This research was conducted in class 7C and 7D at SMP Negeri 1 Wonosobo. Class 7C is defined as the experimental class, while the 7D class is defined as the experimental class. The learning activities in the experimental class using the Science web-module-based guided inquiry integrated with the local potential of the Dieng Mountains Ecosystem, while learning activities in the control class used Science printed book commonly used by teachers. After having treatment, the two classes were asked to work on the post-test questions to find out how were their thinking skills after conducting learning activities in both the control and experiment classes. The post-test data of the control and experiment classes can be seen in the table below.

Table 3. Post-test score of experiment and control class

Description	Experimental Class	Control Class
The number of students	32	32
Maximum score	100,0	90,8
Minimum score	86,7	41,7
Average	97,2	79,8

Based on the data in Table 3., it is seen that the average value of the experimental class is higher than the control class. The difference in the maximum, minimum, and average values between the experimental and control class can be seen more clearly in the diagram below.

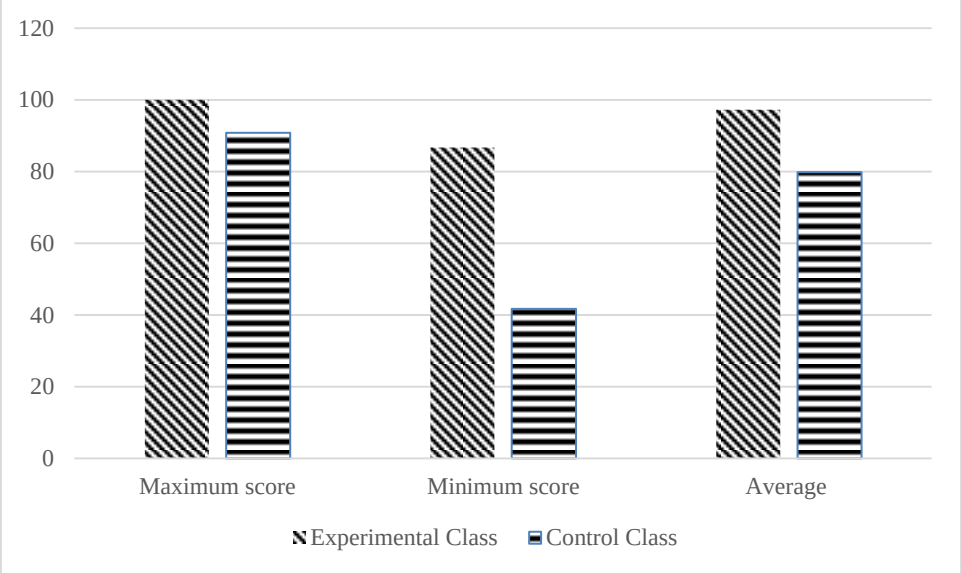

Figure 1. Comparison diagram of thinking skills values in the experiment and control class.

In addition to being asked to do the post-test questions after being given treatment, students from both classes were also asked to fill out a positive attitude questionnaire towards Science. Questionnaire score of positive attitude towards Science in the control class and experiment class can be seen in the table below

Table 4. Questionnaire data on positive attitudes towards science.

Description	Experimental Class	Control Class
The number of students	32	32
Maximum score	4,8	3,5
Minimum score	3,5	1,6
Average	4,3	2,8

Based on the data in Table 4., it can be seen that the average score of the positive attitude towards Science from the experimental class is higher than the control class. The difference in the maximum, minimum, and average values between the experimental and control class can be seen more clearly in the diagram below.

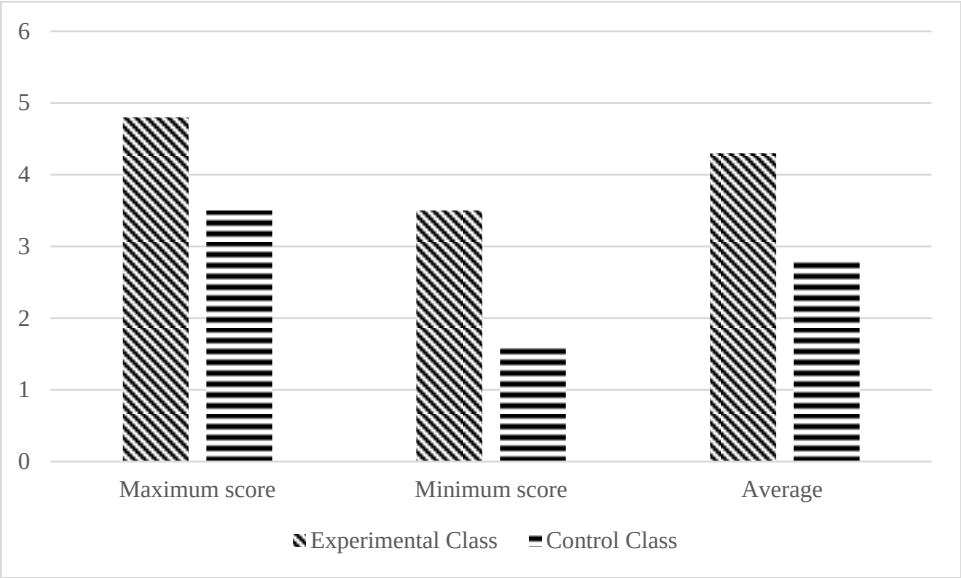

Figure 2. Comparison diagram of scores on positive attitudes towards science in the experimental and control class.

In order to find out the differences in thinking skills and positive attitudes towards Science between the experimental class taught using the Science web-module-based guided inquiry integrated the local potential of the Dieng Mountains Ecosystem with the control class that was taught using science printed books, statistical analysis using the K-Independent Sample Test or Kruskal Wallis test was done with the help of SPSS 22 software. If the Asymp Sig> value of α is set at 0.05, then there is no difference in thinking skills and positive attitudes towards science between the experimental class and the control class. The Asymp Sig < from α set value is 0.05, so there are differences in thinking skills and positive attitudes towards Science between the experimental class and the control class. The Kruskal Wallis test results can be seen in the Table 5. below.

Table 5. Result of Kruskal Wallis Test

Test Statistics[a,b]		
	Score of Thinking Skill	Score of Attitude
Chi-Square	45,922	47,372
Df	1	1
Asymp. Sig.	,000	,000

Based on the result of the kruskal wallis test, it can be seen that the Asymp Sig value is less than 0.05, so it can be concluded that there are differences in positive thinking skills and attitudes towards the experimental class using guided inquiry-based science module web integrated with local potential Dieng Mountain Ecosystem with control class who were taught using science printed books. The result of different thinking skills and positive attitudes towards the science between the experimental and control class indicates that the guided inquiry-based Science web-module integrated the local potential of the Dieng Mountains Ecosystem affects on the students thinking skills and positive attitudes towards science.

The amount of the effect of the science web-module on thinking skills and positive attitudes can be seen by calculating the effect size. The result of the calculation of the effect size on the effect of the science web-module on thinking skills is 0,9. Based on the Cohen effect size criteria, Science web-module-based guided inquiry integrated with the local potential of the Dieng Mountains Ecosystem has a high influence on students' thinking skills. The learning website not only displays a set of material but also graphic, animation, audio, video, search column and link to additional information related to learning topic in the case to enrich the learning and information content that students get (FAO, 2011; Yazdi, 2012). The more students get content and information, the more students have the opportunity to practice their thinking skills.

Module based on guided inquiry that is arranged in full, complete and oriented towards learning objective, can make students to be able to learn the knowledge and skills in full and planned (Taufiq, Dewi & Widiyatmoko, 2014). Thinking skills should be taught through inquiry learning method and activities related to solving the problem. Fine (2015) mentioned that the guided inquiry learning method suggests students be focused on particular learning activity. It means that asking meaningful questions; then students are encouraged to solve these problems by experimenting and then evaluate possible solutions so that students' thinking skills can be trained. This is supported by the result of Hairida's study stated that there are differences in the result of thinking skills between the experimental class using guided inquiry-based learning and control, with the N-gain score indicating that the thinking skills in the experimental class have higher result than control class (Hairida, 2016). Reynolds, Tavares, and Notari (2017) mentioned that learning with inquiry has a positive effect on improving students' thinking skills because during the investigation process students involve all their abilities in processing, sorting or criticizing information to solve the problem in the environment around them.

In addition to being influenced by the learning method used in learning, the content of the learning determined also influences the improvement of student thinking skills (Bustami, Sayifuddin, & Afriana, 2018). The application of contextual problems in learning can improve students' thinking skills. This is supported by research conducted by Azizah and Nasrudin (2014), the research showed that the implementation of learning with learning materials oriented to contextual problems could improve students' thinking skills as indicated by student achievement which continues to increase from one to three cycles.

The result of the effect size calculation on the effect of the science web module on a positive attitude towards science is 0,6. Based on the Cohen effect size criteria, the guided inquiry-based science web module integrated the local potential of the Dieng Mountains Ecosystem has a moderate effect on students' positive attitudes towards science. Hacieminoglu (2016) mentioned that student attitudes to science depend on the approach or method used by the teacher to teach science. Guided inquiry learning method involves a series of observation processes to accept or reject hypotheses. This is an important process in science because students can reconstruct the new knowledge that they get with prior knowledge. Thus the knowledge and learning done is more meaningful and makes students perceived positively towards science (Denessen, Vos, Hacieminoglu, & Louws, 2015; Osborne, Simon, & Collins, 2003). Learning that is presented with the website allows students to do open learning and communication with the teacher whenever and wherever students are. The easiness of access to learning encourages students to be more positive about science (Movahedzadeh, 2012).

Beside being supported by the use of learning methods and media used, positive attitudes towards science can also arise because the topics of learning applied in learning are contextual or close to the lives of students. It makes their attitudes more positive towards science, so the topic of the issue is closely related to students in Indonesia, namely the Dieng Mountains Ecosystem and the problem of land conversion. Learning that is raised from the environment around students makes students have a more positive attitude towards science (Wolf, & Fraser, 2017; Myers, & Fouts, 2012). This is supported by Osman, Iksan, and Halim (2007) research, stated that science material that is considered abstract or irrelevant to student life makes their perspective on science low or negative so that teachers need to raise more learning topics contextual with students' daily lives. The results of Ingram and Samanta's (2003) study showed that contextual learning has a positive influence on students' attitudes and interests in science.

However, the science module web only has a moderate influence on students' positive attitudes towards science because the formation of attitudes is not only influenced by external factors, such as the teacher has tried to develop attitudes, but also influenced by internal factors such as motivation, understanding and perception (Simpson, & Oliver, 2012) This internal factor is the factor of difficult to control, so that the attitude of mining does not significantly increase in the three learning times using the science web-module. Maltz (2002) mentioned that it takes at least 21 days for a person to conform to a new attitude and habit based on the circumstances or stimulus provided. But different opinions expressed by Lally et al., (2010) the time needed to make an attitude conformed takes 18 to 254 days with the average for each is 66 days.

4. Conclusion

There is a difference in thinking skills and positive attitudes towards science between students who are in the experimental class and the control class indicated by the result of the Kruskal Wallis test with the value of Asymp Sig less than 0,05. Guided Inquiry-based Science web-module integrated the local potential of the Dieng Mountains Ecosystem has a high influence on thinking skills as indicated by the effect size of 0,9 included in the high category. Furthermore, the guided inquiry-based science web-module integrated the local potential of the Dieng Mountains Ecosystem has a moderate effect on students' positive attitudes towards science as indicated by the effect size of 0,7 which is in the moderate category.

References

Aktamiş, H., Hiğde, E., & Özden, B. (2016). Effects of the inquiry-based learning method on students' achievement, science process skills and attitudes towards science: A meta-analysis science. *Journal of Turkish Science Education (TUSED), 13*(4), 248-261. doi: 10.12973/tused.10183a

Azizah, U., & Nasrudin, H. (2014). Pemberdayaan kecakapan berpikir siswa SMA bertaraf internasional melalui pengembangan perangkat pembelajaran materi redox reaction berorientasi group investigation cooperative. *Jurnal Pendidikan dan Pembelajaran (JPP), 20*(2), 141-151.

Bustami, Y., Sayifuddin, D., & Afriana, R. (2018). The implementation of contextual learning to enhance biology students' critical thinking skills. *Jurnal Pendidikan Sains Indonesia*, 7(4), 451-457. doi: 10.15294/jpii.v7i4.11721

Carol, et al. (2015). *Thinking Skills and Personal Capabilities for Key Stages 1 & 2*. UK: Northern Ireland Curriculum

Creswell, J., W., 2012, Research design pendekatan kualitatif, kuantitatif dan mixed; Cetakan ke-2, Yogyakarta: Pustaka Pelajar.

Denessen, E., Vos, N., Hasselman, F., & Louws, M. (2015). The relationship between a primary school teacher and student attitudes towards Science and technology. *Education Research International*, . 1-7. doi: 10.1155/2015/534690

FAO. (2011). *E-learning methodologies a guide for designing and developing e-learning course*. Rome: Education Organization of the United Nations

Fine, M. (2015). *Inquiry-based learning: preparing young learners for the demands of the 21st century*. *Educator's Voice, 7*(2), 2-11. Retrieved from https://www.nysut.org/~/media/files/nysut/resources/2015/april/1_edvoiceviii_ch1.pdf?la=en

Gardner, P. (2014). Deciding in democracies: A role for thinking skills?. *Policy Futures in Education, 12*(2), 229-236. doi: 10.2304/pfie.2014.12.2.229

Hacieminoglu, E. (2016). Elementary school students' attitude toward science and related variables. *International Journal of Environmental and Science Education, 11*(2), 35-52. doi: 10.12973/ijese.2016.288a

Hairida, H. (2016). The effectiveness of using inquiry-based natural Science module with the authentic assessment to improve the critical thinking and inquiry skills of junior high school students. *Jurnal Pendidikan IPA Indonesia, 5*(2), 209-215. doi: 10.15294/jpii.v5i2.7681

Jas, I. (2012). Penggunaan media pembelajaran berbasis website dalam pembelajaran matematika. *Journal Pendidikan Matematika UNP, 1*(1). 1-5

Kuhlthau, C. C., Maniotes, L. K., & Caspari, A. K. (2007). *Guided inquiry: Learning in 21st century school*. USA: Greenwood Publishing Group

Lally, P., Van Jaarsveld, C. H., Potts, H. W., & Wardle, J. (2010). How are habits formed: Modelling habit formation in the real world. *European journal of social psychology, 40*(6), 998-1009

Maisah, Marjono & Arianto. (2017). Pengaruh model pembelajaran inkuiri terbimbing terhadap kemampuan berpikir kritis siswa kelas X MIA pada materi pencemaran lingkungan di Surakarta. *Jurnal Bioedukasi*, *10*(1), 71-78

Maltz, M. (2002). New Psycho-Cybernetics. Penguin.

Miri, B., David, B. C., & Uri, Z. (2007). Purposely teaching for the promotion of higher-order thinking skills: a case of critical thinking. *Journal of Research in Science Education*, 37(4), 353-369. doi: 10.1007/s11165-006-9029-2

Movahedzadeh, F. (2012). Improving students' attitude toward science through blended learning. *Science Education & Civic Engagement An International Journal*, *3*(2), 13-19. doi: 10.12691/wjce-5-4-4

Muzakir. (2012). Pengembangan life skill dalam pembelajaran sains. *Jurnal Ilmiah Didaktika.* 13(1). doi: 10.22373/jid.v13i1.460

Myers, R.E & Fouts, J.T. (2012). An analysis of high school science environments and attitude toward science. *Journal of Research in Science Teaching, 29*(9), 929-937. doi: 10.1002/tea.3660290904

National Education Association. (2012). *Audiovisual instruction department, New Media, and College Teaching*. Washington, D. C.: NEA.

Nijman, V. (2000). A faunal survey of the Dieng Mountains, Central Java. Indonesia. *Journal of Distribution and Conservation of Endemic Primate Taxa*. 32(2), 35-46. doi: 10.1046/j.1365-3008.1998.d01-24.x

Nugraha, Suyitno, & Susilaningsih. (2017). Analisis kemampuan berpikir kritis ditinjau dari keterampilan proses sains dan motivasi belajar melalui model PBL. *Jurnal of Primary Education, 6*(1), 35-43

Osborne, J., Simon, S., & Collins, S. (2003). Attitudes towards science: A review of the literature and its implications. *International journal of science education*, *25*(9), 1049-1079.

Osman, K., Iksan, Z. H., & Halim, L. (2007). Sikap terhadap sains dan sikap saintifik di kalangan pelajar sains. *Jurnal Pendidikan, 32*(3), 39-60. doi: 14717/4471

Prastowo, A. (2015). *Pandan kreatif membuat bahan ajar inovatif.* Yogyakarta: Diva Press

Reynolds, R., Tavares, N. J., & Notari, M. (2017). 21st century skills development through inquiry-based learning. *Journal of Educational Technology Research and Development,* 59(2), 267-289. doi: 10.1007/978-981-10-2481-8_1

Selcuk, Caliskan & Erol. (2008). The Effect of Problem Solving Instruction on Physics Achievement, Problem Solving Performance a Strategy Use. *Journal of Physics Education, 2*(3). 151-166?. doi: 10.1016/j.sbspro.2010.03.315

Simpson, R. D., & Oliver. J. S. (2012). *A summary of major influences on attitude toward science among adolescent students*. *Science Education, 74*(1), 1-18. doi: 10.1002/sce.3730740102

Stern, P.C., Kalof, L., Dietz, T., & Guagnano, G.A. (2012). Values, beliefs, and proenvironmental action: attitude formation toward emergent attitude objects. *Journal of Applied Social Psychology, 25*(18), 1611-1636. doi: 10.1111/j.1559-1816.1995.tb02636.x

Supriyatna, J. (2008). *Melestarikan alam Indonesia*. Jakarta: Yayasan Obor Indonesia.

Taufiq, Dewi & Widiyatmoko. (2014). Pengembangan media pembelajaran IPA terpadu berkarakter peduli lingkunga tema "konservasi" berpendekatan science-edutainment. *Jurnal Pendidikan IPA Indonesia, 3*(2), 140-145. doi: 10.15294/jpii.v3i2.3113

Trilling & Fadel. (2009). *21st century skills learning for life in our times*. San Francisco: Jossey-Bass

Wijaya, E. Y., Sudjimat, D. A., & Nyoto, A. (2016). Transformasi pendidikan abad 21 sebagai tuntutan pengembangan sumber daya manusia di era global. In *Prosiding Seminar Nasional Pendidikan Matematika* (Vol. 1, No. 26, pp. 263-278).

Wolf, S. J., & Fraser, B. J. (2017). Learning Environment, Attitudes, and Achievement among Middle-school Science Students Using Inquiry-based Laboratory Activities. *Research in Science Education, 38*(3), 321-341. doi: 10.1007/s11165-007-9052-y

Yazdi, M. (2012). E-Learning sebagai media pembelajaran interaktif berbasis teknologi informasi. *Jurnal Ilmiah Foristek, 2*(1), 143-152. Retrieved from http://jurnal.untad.ac.id/jurnal/index.php/FORISTEK/article/view/665/584