Students' Critical Thinking Ability Reviewed Learning Styles in Learning with SCAMPER Method the Assisted by E-Module

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Article Info

Abstract

The ability to think critically is a must for students in the learning process because it can support understanding a problem appropriately and systematically. This research aims to describe the quality of learning with SCAMPER method the assisted by e-module on students' critical thinking ability and describe students' critical thinking ability in terms of learning styles. This type of research is mixed method research. The subjects in this study were students of class XI AKL 2 in the academic year 2020/2021. Data obtained from critical thinking ability tests, learning style questionnaires, student response questionnaires, and interviews. The quantitative data analysis includes the average achievement test, the proportion test, the average difference test, the proportion difference test, and the average increase difference test. Qualitative data analysis includes data reduction, data presentation, and making conclusions. The results showed that learning mathematics using the SCAMPER method assisted by e-module can be said to be of high quality. This is based on the results at the planning stage and the implementation stage in the minimal good category and at the assessment stage, it is said to be effective. Students' critical thinking ability viewed from the learning style in learning with the SCAMPER method assisted by e-module that to get the high category TKBK at least master three indicators, the medium category students master two indicators, and the low category master at most one indicator.

INTRODUCTION

Thinking is a process of mixing, matching, combining, exchanging, and sorting concepts, perceptions, and previous experiences, as well as parts of knowledge that humans get (Kuswana, 2011). Thinking is a very dynamic process that takes three steps, namely forming an understanding, forming opinions, and forming decisions. The three steps can be divided into several groups of students' thinking abilities, one of which is critical thinking.

Critical thinking considered a series of self-regulatory tactics in determining decisions that yield multiple solutions. Critical thinking ability are among the highest order thinking ability. Critical thinking is deemed a series of decisive self-regulation tactics and decisions resulting in multiple outcomes. The ability to identify problems is a subability of critical thinking (Lin, Hu, & Chiu, 2019). However, the results of the 2018 PISA study (OECD, 2019) show that in the category of mathematical ability Indonesia is ranked 73 out of 79, it is the seventh rank from below, with an average score of 379. Agusman (2017) also shows that students find it difficult to arrange problem-solving steps and explain the results of their thinking. Therefore, improvements must be carried out, one of which is the ability to think at a higher level or think critically. The level of critical thinking ability of students is also influenced by several things, including factors that come from within and from outside the student (Usman, Utami, & Yulita, 2020).

One of the factors within students is genetic or inherited factors whose activities are carried out repeatedly so that it becomes a habit, one of which is the learning style (Sundayana, 2018). Learning styles defined as the way students concentrate, process, internalize and remember new academic information (Priyatna, 2013). Different learning means teaching the same content to different students using different learning strategies (Patel & Singh, 2014). This involves modifying the content (what to teach), the process (how to teach it), and the product (how learners demonstrate their learning) to suit the needs of each learner (Mangwende & Maharaj, 2019).

According to DePorter and Hernacki (2013), student learning style is a way of learning that is owned by each individual which is the easiest way to absorb, organize, and process information. A person's learning style is divided into three, that is visual humans, auditory humans, and kinesthetic humans (Wahyuni, 2017). Other factors come from outside the student, such as the environment, family, and education. These factors can be manipulated or planned to support growing critical thinking ability.

One of the efforts made to improve critical thinking ability and pay attention to student learning styles is by improving the teaching and learning process. This effort is to use the Problem Based Learning (PBL) model with the method of Substitute, Combine, Adapt, Modify, put to other uses, Eliminate, Rearrange (SCAMPER). This method was invented by Alex Osborn and reconstructed by Bob Eberle in the early 70's. The orientation of SCAMPER is to produce a product creatively based on emerging ideas that are discussed collectively or even individually (Hawa & Yosef, 2019).

The seven steps in SCAMPER are combined with indicators in critical thinking, namely interpretation (substitute), analysis (combine and adapt), evaluation (modify and put into another use), and inference (Eliminate and Rearrange). SCAMPER was formed essentially based on the Chinese philosophy which says that something new comes from the modification of something that already exists (Radziszewski, 2017). SCAMPER activities encourage all students to create new ideas that are different from one another (Moreno, Yang, Hernández, & Wood, 2014). This emphasizes to students that a problem does not only have a solution but many and various solutions (Toraman & Altun, 2013). This solution can be seen from each student's learning style.

Teacher activities and the use of media in learning are things that can be done by teachers in maximizing the learning styles possessed by each student to understand the material presented. One of the media that can be used is a module. Along with technological developments, the form of the module can be converted into an e-module (electronic module) (Jamaluddin & Roisatun, 2018). However, Marbán & Mulenga (2019) observed that the attitude of mathematics teachers towards the use of information and communication technology (ICT) media is an obstacle to teaching mathematics.

Technological developments are developing so rapidly and rapidly. The use of e-modules as a

learning medium is expected to make students more active in seeking information and be able to practice their critical thinking ability (Suarsana & Mahayukti, 2013). E-module is a new teaching material in the process of learning activities that use electronic media as a distributor of information in a concept package that is following the need to increase knowledge and skills (Nugraha, Subarkah, & Sari, 2015). E-module can be mixed with innovative learning models that are considered capable of improving learning outcomes (Winatha, Suharsono, & Agustini, 2018).

According to (Smeets & Bus, 2015) that e-modules inserted with multimedia features can enrich the book reading experience if used properly. This is a new idea that can be developed according to today's needs, by eliminating the negative impacts of smartphones and replaced with positive impacts that provide many benefits, especially in the development of education in Indonesia. This is similar to research conducted on learning using e-module media, students' critical thinking skills have increased significantly and are of high value (Rokhmania & Kustijono, 2017).

The purpose of this study is to describe the quality of learning with the e-module assisted SCAMPER method on students' critical thinking ability and describe students' critical thinking ability in terms of learning styles.

METHOD

This study uses a mixed method research method with a concurrent embedded model. This model can be characterized as a mixed methods method that employs one stage of quantitative and qualitative data collection at a time. The choice of this model is because the collection of quantitative and qualitative data in the study is carried out simultaneously. Qualitative data reinforce quantitative data.

This research was conducted at SMK Swadaya Temanggung. The sample in this study were students of class XI AKL 2 and XI AKL 3 in the academic year 2020/2021, each of which consisted of 36 students. Research sampling in this study is determined through techniques cluster random

sampling selected one experimental class and one control class. The experimental class applied the PBL model with the SCAMPER method and the control class applied the PBL model.

Data analysis before starting the study was carried out by validating the research tools and instruments. Data analysis in this study is divided into two, namely quantitative data analysis and qualitative data analysis. Quantitative data analysis is divided into preliminary data analysis and final data analysis. The preliminary data analysis was taken from the results of the initial test of critical thinking ability to know that the two sample classes started from the same initial conditions, while the final data analysis was taken from the results of the final test of critical thinking ability whose data were used for completeness and difference tests. Qualitative data analysis uses three main steps, namely data reduction, data presentation, and making conclusions.

RESULTS AND DISCUSSIONS

The quantitative analysis in this study is about the quality of SCAMPER learning assisted by e-modules on critical thinking ability. The quality of learning is obtained based on three stages. The three stages consist of the planning stage, the implementation stage, and the assessment stage. At the planning stage, the learning tools that have been compiled are valid, at the implementation stage, the learning implementation is in a good category and gets a positive response, at the assessment stage, it has fulfilled the effectiveness test.

The planning stage in this study includes the preparation of learning tools, namely the preparation of syllabus, Learning Implementation Plan (RPP), teaching materials, Student Worksheets (LKS), Critical Thinking Ability Test (TKBK) questions, learning style questionnaires, and interview guidelines. The learning tools that have been compiled by the researcher are then proposed to be validated by expert validators. In the following, the data from the recapitulation of validity conducted by experts will be presented in Table 1.

Table 1. Average of Expert Validation Test Results

No.	Device Type	Average Score	Category
1	Syllabus	3.6	Very good
2	RPP	3.5	Very good
3	Teaching materials	3.2	Good
4	LKS	3.2	Good
5	TKBK	3.3	Very good
6	Questionnaire	3.2	Good
7	Interview	3.4	Very good

The learning device is categorized as good, so it is used in this study.

The implementation stage was carried out by looking at the results of the student response questionnaire. Student response questionnaires were filled in by students by assessing the learning process that was taking place. Minimal learning implementation is in a good category. The results of the assessment of the implementation of learning with an average score of 3.03 and a percentage of 76%. That matter shows that the student response in following the lesson with the e-module assisted SCAMPER method falls into the good category. This means that the average student feels happy and can take part in the learning so that it can motivate students in learning.

The assessment stage is to test the hypothesis analysis. Before testing the hypothesis analysis, it is necessary to test the normality and homogeneity test. The results of the normality test indicate that the Sig. in the control class, namely the class with PBL learning of 0.2>0.05, then H_0 be accepted. Nilai Sig. in the experimental class, namely the class withe-module assisted SCAMPER learning method equal to 0.105>0.05 then H_0 be accepted. This means that the test scores for critical thinking ability are normally distributed. Then for the homogeneity test indicates that the Sig. is 0.761>0.05 then H_0 be accepted. This means that the variance of the test scores of the class using learning with the e-module assisted SCAMPER method and classes that use the same or homogeneous PBL learning.

After the prerequisite test, then the hypothesis analysis test is carried out. The first hypothesis test is an average completeness test with a predetermined actual completion limit of 53.35. The results of the hypothesis test analysis indicate that the Sig. is 0.000<0.05 then H_0 is rejected. This means that the average value of TKBK class using learning with the e-module assisted SCAMPER method is more than 53.35. A second hypothesis test is a test of the proportion of completeness. That hypothesis test results show that the value of Sig. is 0.436 <0.05 then H_0 be accepted. It means that the proportion of students learning with the e-module assisted SCAMPER method to achieve minimum completeness of at most 75%.

The third hypothesis test is a test of the difference between two means. That hypothesis test results indicate that the results of testing the difference between the two mean values of Sig. (2-tailed) of 0.43. At a significant level, the Sig. 0.43<0.05, so H0 is rejected and H1 is accepted. This means the class average $\propto= 5\%$ with the e-module assisted SCAMPER method more than the class with the PBL model. A fourth hypothesis test is a test for the difference between two proportions. That Hypothesis test results indicate that the results of the test for the difference between the two proportions are obtained Asymp. Sig. amounting to 0,000. At a significant level $\propto= 5\%$ then the value Asymp. Sig. 0,000<0,05 then H_1 be rejected and H_0 be accepted. This means that the proportion of students' critical thinking ability in the class with the e-module assisted SCAMPER method is more than classroom students with the PBL model. A fifth hypothesis test is a test of the difference between the two means of improvement. That hypothesis test results indicate that the results of testing the difference between the two mean values of Sig. (2-tailed) by 0.00. At a significant level, the Sig. 0.00<0.05, so H0 is rejected and H1 is accepted. This means that the average increase in class critical thinking ability with the SCAMPER method assisted by e-module is more than the class with the PBL model in $\propto= 5\%$.

Based on the hypothesis analysis test, the learning quality criteria at the assessment stage have been fulfilled. This is in line with research conducted by(Mandasari, Hawa, & Yosef, 2020) schools can be a means for teachers to develop or spur students' creative ideas through the SCAMPER method. This means that the SCAMPER method is effective in improving critical thinking ability.

The results of the three stages of measuring the quality of learning show that at the planning stage and the implementation stage of learning is in a good category, and at the assessment stage the results are effective, it can be concluded that learning using the SCAMPER method assisted by e-module is of high quality. This is supported by the results of the research conducted (Hawa & Yosef, 2019) that method SCAMPER can develop critical and creative thinking ability in sample students. Besides that research is being done by Tahir and Marniati (2019) that there are differences in problem-solving abilities between students taught using the SCAMPER method and students taught using conventional methods.

Qualitative analysis in this study is about critical thinking ability in terms of learning styles. The critical thinking ability in this study is based on 4 indicators according to Karim & Normaya (2015). The achievement of each subject in the TKBK results in terms of learning styles has different levels (Setiana & Purwoko, 2020). TKBK results show that subjects with TKBK in the high category can pass well at least three indicators. Subjects with medium category TKBK were able to get through two indicators well. Subjects with low category TKBK were able to get through one indicator well.

The achievement of the subject in terms of visual learning styles with high category TKBK results shows that the subject can pass through the four indicators (interpretation, analysis, evaluation, and inference) well. The achievement of the subject in terms of visual learning style with the results of TKBK in the medium category shows that the subject can pass two indicators (interpretation and analysis) well and less on two indicators (evaluation and inference). The achievement of the subject in terms of visual learning styles with low category TKBK results indicates that the subject can go through one

indicator (analysis) quite well and less on three indicators (interpretation, evaluation, and inference).

The achievement of the subject in terms of auditory learning style with high category TKBK results shows that the subject can pass through three indicators (interpretation, analysis, and evaluation) well and less on one indicator (inference). The achievement of the subject in terms of auditory learning style with the results of TKBK in the medium category shows that the subject can pass two indicators (interpretation, analysis) well and is lacking in two indicators (analysis and inference). The achievement of the subject in terms of auditory learning styles with low category TKBK results indicates that the subject can go through two indicators (interpretation and analysis) quite well and lacks two indicator indicators (evaluation and inference).

The achievement of the subject in terms of kinesthetic learning style with high category TKBK results shows that the subject can pass through the four indicators (interpretation, analysis, evaluation, and inference) well. The achievement of the subject in terms of kinesthetic learning style with the results of TKBK in the medium category shows that the subject can pass two indicators (interpretation, analysis) well and is lacking in two indicators (analysis and inference). The achievement of the subject in terms of inesthetic learning style with low category TKBK results indicates that the subject can go through one indicator (analysis) quite well and is lacking in three indicators (interpretation, evaluation, and inference).

This is the same with research conducted by Maftuh (2018) also stated that the subject with a visual learning style in solving open mathematics problems met three indicators of creativity; that is, fluency, flexibility, and novelty. Subjects with auditory learning styles in solving open mathematics problems only fulfill one indicator of creativity; that is fluency, while subjects with a kinesthetic learning style in solving open mathematics problems only fulfill one indicator of creativity; that is fluency.

Another research conducted by Firdaus, Nisa, and Nadhifah (2019) that students with concrete sequential thinking styles can master abilities 1, 2, 3, and 4. Students with abstract sequential thinking styles are only able to master ability 4. Students with abstract random thinking styles can master the ability

1. Students with concrete random thinking styles can master abilities 1, 2, and 3.

CONCLUSION

Based on the analysis and discussion, it is concluded that learning mathematics using the SCAMPER method assisted by e-module is said to be of high quality. This is based on the results at the planning stage and the implementation stage in the minimal good category and at the assessment stage, it is said to be effective. Students' critical thinking ability in terms of learning styles in learning with the e-module-assisted SCAMPER method are that to get TKBK in high categories students are at least able to exceed at least three indicators (interpretation, analysis, evaluation) well and one indicator (inference) is good enough. Students are included in the medium category TKBK, students are at least able to exceed two indicators (interpretation, analysis) well and two indicators (analysis and inference) are good enough. For students to enter TKBK in the low category, students are at least able to exceed at most one indicator (interpretation) well and three indicators (analysis, evaluation, and inference) are quite good.

REFERENCES

Agusman, A. (2017). Desain Model Pembelajaran Matematika Yang Mengembangkan Kemampuan Berpikir Kritis. JPM: Jurnal Pendidikan Matematika, 2(2), 111–121.

DePorter, B., & Hernacki, M. (2013). Quantum Learning. Membiasakan Belajar Nyaman dan Menyenangkan. Bandung: Penerbit Kaifa.

Firdaus, A., Nisa, L. C., & Nadhifah, N. (2019). Kemampuan Berpikir Kritis Siswa pada Materi Barisan dan Deret Berdasarkan Gaya Berpikir. Kreano, Jurnal Matematika Kreatif-Inovatif, 10(1), 68–77. https://doi.org/10.15294/kreano.v10i1.17822

Hawa, S., & Yosef, Y. (2019). Aplikasi Metode Scamper Dalam Pengembangan Desain Pembelajaran Matematika di Sekolah Dasar. Jurnal Pendidikan Matematika, 13(2), 143–152.

Jamaluddin, M., & Roisatun, N. (2018). PENGEMBANGAN E-MODUL INTERAKTIF BERBASIS PROYEK PADA MATA KULIAH SISTEM EVALUASI PEMBELAJARAN MATEMATIKA. APOTEMA: Jurnal Program Studi Pendidikan Matematika, Volume 4, No. 2. Juli 2018. https://doi.org/10.23887/jptk-undiksha.v15i2.14021

Kuswana. (2011). Taksonomi Berpikir. Bandung: Remaja Rosdakarya.

Lin, S., Hu, H.-C., & Chiu, C.-K. (2019). Training Practices of Self-efficacy on Critical Thinking Skills and Literacy: Importance-Performance Matrix Analysis. Eurasia Journal of Mathematics, Science and Technology Education, 16(1), 1–10. https://doi.org/10.29333/ejmste/112202

Maftuh, M. S. (2018). KREATIVITAS SISWA SMP DALAM PEMECAHAN MASALAH MATEMATIKA TERBUKA DITINJAU DARI GAYA BELAJAR. Buana Matematika: Jurnal Ilmiah Matematika Dan Pendidikan Matematika. https://doi.org/10.36456/buana_matematika.7.2:.1047.75-84

Mandasari, Wi., Hawa, S., & Yosef. (2020). PENERAPAN METODE SCAMPER TERHADAP HASIL BELAJAR DAN KEAKTIFAN PESERTA DIDIK KELAS IV SEKOLAH DASAR. Jurnal Inovasi Sekolah Dasar, 7, 66–73.

Mangwende, E., & Maharaj, A. (2019). Barriers to Mathematics Teachers' Use of Their Knowledge of Students' Learning Styles in Mathematics Teaching: A Case of Secondary Schools in Zimbabwe. Eurasia Journal of Mathematics, Science and Technology Education, 16(1), 1–15.

Marbán, J. M., & Mulenga, E. M. (2019). Pre-service Primary Teachers' Teaching Styles and Attitudes towards the Use of Technology in Mathematics Classrooms. International Electronic Journal of Mathematics Education, 14(2), 253–263.

Moreno, D. P., Yang, M. C., Hernández, A. A., & Wood, K. L. (2014). Creativity in transactional design problems: non-intuitive findings of an

expert study using scamper. Proceedings of International Design Conference, DESIGN, 569–578.

Nugraha, A., Subarkah, C. Z., & Sari. (2015). Penggunaan E-Module Pembelajaran pada Konsep Sifat Kologatif Larutan untuk Mengembangkan Literasi Kimia Siswa. Prosiding Simposium Nasioanal Inovasi Dan Pembelajaran Sains, 201–204.

OECD. (2019). Summaries, Combined Executive PISA 2018 Results. I.

Patel, K. L., & Singh, S. (2014). Matching and Mismatching of learning styles and teaching styles: A conceptual perspective. 4, 20-26. Shaikshik Parisamvad (An International Journal of Education) SPIJE, 4(2), 20–26.

Priyatna, A. (2013). Pahami Gaya Belajar Anak! Memaksimalkan Potensi Anak dengan Modifikasi Gaya Belajar. Jakarta: PT Gramedia.

Radziszewski, E. (2017). SCAMPER and Creative Problem Solving in Political Science: Insights from Classroom Observation. Journal of Political Science Education, 13(15), 1–9.

Rokhmania, F. T., & Kustijono, R. (2017). Efektivitas penggunaan e-modul berbasis flipped classroom untuk melatih keterampilan berpikir kritis. Seminar Nasional Fisika, 91–96.

Setiana, D. S., & Purwoko, R. Y. (2020). Analisis kemampuan berpikir kritis ditinjau dari gaya belajar matematika siswa. Jurnal Riset Pendidikan Matematika.

Smeets, D. J. H., & Bus, A. G. (2015). The interactive animated e-book as a word learning device for kindergartners. Applied Psycholinguistics, 36(4), 899–920. https://doi.org/10.1017/S0142716413000556

Suarsana, I. M., & Mahayukti, G. A. (2013). Pengembangan E-Modul Berorientasi Pemecahan Masalah Untuk Meningkatkan

Keterampilan Berpikir Kritis Mahasiswa. Jurnal Nasional Pendidikan Teknik Informatika (JANAPATI), 2(3), 193.

Sundayana, R. (2018). Kaitan antara Gaya Belajar, Kemandirian Belajar, dan Kemampuan Pemecahan Masalah Siswa SMP dalam Pelajaran Matematika. Mosharafa: Jurnal Pendidikan Matematika. https://doi.org/10.31980/mosharafa.v5i2.262

Tahir, & Marniati. (2019). PENERAPAN METODE SCAMPER DALAM MENGEMBANGKAN KEMAMPUAN PEMECAHAN MASALAH DITINJAU DARI MOTIVASI MAHASISWA PENDIDIKAN MATEMATIKA UNIVERSITAS SEMBILANBELAS NOVEMBER KOLAKA. JURNAL SILOGISME: Kajian Ilmu Matematika Dan Pembelajarannya, 2(2), 43–48.

Toraman, S., & Altun, S. (2013). Application of the Six Thinking Hats and SCAMPER Techniques on the 7th Grade Course Unit "Human and Environment": An Exemplary Case Study. Mevlana International Journal of Education. https://doi.org/10.13054/mije.13.62.3.4

Usman, Utami, E., & Yulita, N. (2020). HUBUNGAN BERPIKIR KRITIS DENGAN KREATIVITAS SISWA MELALUI MIND MAP PADA PEMBELAJARAN BIOLOGI. 7(2), 32–41.

Wahyuni, Y. (2017). Identifikasi Gaya Belajar (Visual, Auditorial, Kinestetik) Mahasiswa Pendidikan Matematika Universitas Bung Hatta. JPPM, 10(2), 128–132.

Winatha, K. R., Suharsono, N., & Agustini, K. (2018). Pengembangan E-modul Interaktif Berbasis Proyek Mata Pelajaran Simulasi Digital. Jurnal Pendidikan Teknologi Dan Kejuruan, 15(2). https://doi.org/10.23887/jptk-undiksha.v15i2.14021