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Development of Online Inquiry Learning Model Based on Ethnomathematics Javanese Culture for Middle School Students

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ABSTRACT

The success of character education during the Covid 19 pandemic experienced many obstacles, considering that learning at school was carried out online. However, through the online system, the massive development of information technology may erode the noble cultural character of students. Efforts to create students with characteristics that match the personality of the Indonesian nation during the Covid 19 pandemic are not enough through the implementation of learning based on the curriculum that has been implemented. These efforts can be made through ethnomathematics, namely integrating cultural elements into learning mathematics. Inquiry learning is done through investigation and discovery to develop conceptual understanding. This study aims to develop an online inquiry mathematics learning model based on Javanese cultural ethnomathematics. The research method to be carried out in Research and Development refers to the educational development model from Plomp. The construction phase begins with coordination activities with the school where the research trials are carried out. Then a small-scale trial was carried out by carrying out online learning using the learning model that had been developed. Small-scale trials were conducted in four schools. Furthermore, the implementation of large-scale trials in eight schools. The twelve schools are from junior high schools in the Yogyakarta Provinces, Central Java Provinces, and East Java Provinces. The test, evaluation, and revision stages continue the previous stage. The model is validated by a judgment expert, namely an expert in mathematics learning models, to test whether the developed model can be understood and accepted by users. The study's results showed that the user's assessment of the Javanese ethnomathematics-based inquiry learning model showed excellent results. Users state that they understand the learning model developed, including the learning model's syntax, social systems, learning principles, learning support systems, instructional impacts, and accompanying impacts. The user ratings of the learning module show high scores in the introductory, content, evaluation, and closing aspects. Users also stated good results for student worksheets, including aspects of the completeness of student worksheet components, content, materials, language, and learning model requirements.

Keyword: Model of Learning, inquiri online, etnomatematics, culture of java

ABSTRAK

Keberhasilan pendidikan karakter pada masa pandemi covid 19 mengalami banyak kendala, mengingat pembelajaran di sekolah dilakukan secara daring (online). Namun melalui sistem daring, tidak menutup kemungkinan karakter budaya luhur siswa akan terkikis oleh adanya perkembangan teknologi informasi yang begitu massive. Upaya bersama untuk mewujudkan siswa yang berkarakter pada nilai-nilai karakter yang sesuai dengan kepribadian bangsa Indonesia pada saat kondisi pandemi Covid 19 tidak cukup melalui pelaksanaan pembelajaran yang berdasarkan kurikulum yang sudah diberlakukan. Upaya tersebut dapat dilakukan melalui etnomatematika, yaitu mengintegrasikan unsur budaya ke dalam pembelajaran matematika. Pembelajaran dilaksanakan secara inquiry melalui penyelidikan dan penemuan untuk mengembangkan pemahaman konsep. Tahap realisasi/konstruksi diawali kegiatan koordinasi dengan pihak sekolah tempat pelaksanaan uji coba penelitian.

Selanjutnya dilaksanakan uji coba skala kecil dengan melaksanakan pembelajaran daring menggunakan model pembelajaran yang telah dikembangkan. Uji coba skala kecil dilakukan pada 4 sekolah. Selanjutnya pelaksanaan uji coba skala besar pada 8 sekolah. Kedua belas sekolah diambil dari SMP yang berasal dari Provinsi DIY, Jawa Tengah dan Jawa Timur. Tahap tes, evaluasi, dan revisi merupakan lanjutan dari tahap sebelumnya. Pada tahap ini dilaksanakan tes pada seluruh siswa subjek penelitian serta pengambilan data melalui kuisioner menggunakan google form. Tes dilaksanakan untuk memperoleh data pemahaman konsep matematika siswa, sedangkan kuisioner digunakan untuk memperoleh data kepraktisan produk. Selanjutnya dilakukan analisis terhadap hasil uji coba dan pelaksanaan tes. Hasil analisis dijadikan dasar dalam melaksanakan revisi produk hingga diperoleh produk model pembelajaran final. Hasil penelitian menunujukan bahwa penilaian pengguna terhadap model pembelajaran inquiry berbasis etnomatematika budaya jawa menunjukan hasil yang sangat baik. Pengguna menyatakan bahwa mereka memahami model pembelajaran yang dikembangkan meliputi sintaks model pembelajaran, sistem sosial, prinsip pembelajaran, sistem pendukung pembelajaran, dampak instruksional dan dampak pengiring. Penilaian pengguna terhadap modul pembelajaran menunjukan nilai yang tinggi pada aspek pendahuluan, aspek isi, aspek evaluasi dan aspek penutup. Pengguna juga menyatakan hasil yang baik untuk LKPD yang meliputi aspek kelengkapan komponen LKPD, kesesuaian isi dan materi, kebahasaan dan kesesuaian syarat model pembelajaran.

Kata kunci: model pembelajaran, inquiri daring, etnomatematika, budaya jawa

INTRODUCTION

Changes in the world are entering the era of the industrial revolution 4.0, where information technology has become the basis of human life. Information and communication technology is fully utilized, including intelligent robots, which are considered capable of degrading human roles. Information and communication technology, which is developing rapidly, has also penetrated the world of education, so the terms e-learning, online learning, and online courses have emerged. In this case, digital media is a primary requirement in learning, especially with the Covid-19 pandemic, which demands a policy in the education sector through online learning (Sadikin & Hamidah, 2020). On the one hand, online learning makes it possible to implement the independent learning program initiated by the Ministry of Education and Culture.

The Father of National Education has long echoed the term independent learning through the teachings of Tamansiswa. Through independent learning, Ki Hadjar Dewantara teaches the spirit and ways of educating Indonesian children to become human beings who are independent in mind, free in thought, and free in body/energy. Of course, this policy is straightforward, especially in online learning conditions with all the space limitations. Through this policy, schools can use a curriculum that adapts to student's learning needs and conditions.

A lot of exciting content in cyberspace allows students to do more online/online activities. Suppose there is no supervision from parents or personal awareness to limit oneself. In that case, internet users will have a negative impact, including eroding the nation's noble cultural character values. It happens due to a lack of application and understanding of the importance of cultural values in society. The erosion of this cultural character value is seen in current phenomena such as violence, riots, self-destructive activities, juvenile delinquency, and others.

Every student must achieve learning outcomes from each subject he studies, and one of these subjects is mathematics, which is a valuable science subject and has been used in all aspects of

human life (Sukmanasa et al., 2020). Mathematics is an exact science that studies thinking patterns, logical proofs, organizational patterns, and several concepts (Kamid et al., 2021). Mathematics is a compulsory subject based on concepts and processes arranged systematically, logically, and hierarchically related to thinking and decision-making processes (Patri & Heswari, 2022).

Mathematics is a complicated subject; there are too many formulas to memorize. It is only the science of calculating; mathematics is boring, and it is an abstract science, and its application in everyday life is unclear (Patri & Heswari, 2022). Each individual has a different ability to master mathematical concepts, so it is very influential on the ability to solve problems or math problems. Students in mathematics need process skills that students can learn at the school level to make it easier to understand lessons (Kamid et al., 2021). Teachers who can design abstract mathematics learning to turn learning into concrete with visual aids will be able to improve student learning outcomes. Furthermore, several contexts can be used as a starting point in learning mathematics (Masniladevi et al., 2017).

Mathematics is a symbolic technology that grows on cultural and environmental skills or activities. Ethnomathematics is a representation that describes the cultural influence of the use of mathematics in its application (Patri & Heswari, 2022). Ethnomathematics is a way to study mathematics by involving activities or local culture to make it easier for someone to understand (Sarwoedi et al., 2018). Ethnomathematics is learning mathematics studied in a culture related to customs and art that fulfills aesthetic values (Narulita et al., 2019).

The existence of ethnomathematics is expected to increase students' abilities in learning mathematics to the fullest because, during the learning process, students are given questions or problems related to their daily culture such as counting, collecting, processing, and interpreting data (Sarwoedi et al., 2018). Ethnomathematics exploration requires carefulness in uncovering the mathematical concepts observed in traditional activities. This condition allows for errors in the disclosure of concepts, and less than optimal exploration is carried out so that only very few concepts are disclosed (Wahyuni et al., 2022).

Students' low critical thinking skills are caused by several factors that influence the learning process, which can be from a teacher, student, or other supporting factors for the implementation of learning (Sutarningsih, 2022). There are various methods adapted for teaching mathematics, including the inquiry-based method. Inquiry is defined as seeking reality or knowledge and exploring information by asking questions (Mehmood et al., 2019). Inquiry is a learning strategy that stimulates, teaches, and invites students to think critically, analytically, and systematically to find answers independently of the various problems raised (Sutarningsih, 2022).

The inquiry method is a method that positions and requires teachers to help students find data, facts, and information on their own from various sources so that these activities can provide beneficial experience in dealing with and solving problems in their lives (Alsan, 2019). The main characteristics of the inquiry learning strategy, namely (a) the inquiry model emphasizes student activity to the maximum to search and find, meaning that students are placed as learning subjects, (b) all activities carried out by students are directed to seek and find their own answers to something in question, so that it is expected to foster self-confidence, and (c) the purpose of using the inquiry learning model

is to develop the ability to think systematically, logically and critically or develop intellectual abilities as part of a mental process (Zuldesnita & Astimar, 2020).

Learning mathematics is expected to be a vehicle for students to learn about their abilities and apply them in everyday life. Therefore, in learning mathematics, it is necessary to find a solution and develop a method that emphasizes analytical and critical thinking to seek and find answers to a problem in question.

METHOD

The research to be carried out is research and development (Research and Development), which refers to the educational development model from Plomp. The activities in developing the learning model are (1) Initial Investigation Stage. This stage has been carried out through FGDs and the identification of ethnomathematics objects at ten cultural sites in the Provinces of DIY, Central Java, and East Java. (2) Design/Design Stage, namely designing learning models. (3) Realization/Construction Stage involves small-scale and large-scale trials. (4) Test, Evaluation, and Revision Stage, namely data analysis and product revision, and (5) Implementation and dissemination. The research subjects were class VIII students from 28 junior high schools (SMP) in DIY, Central Java, and East Java provinces.

Research data on learning outcomes (conceptual understanding) were collected using test instruments, while student response data related to the practicality of learning models were collected through online questionnaires. These data were then analyzed using quantitative descriptive analysis techniques. The expected research results are an online inquiry mathematics learning model based on Javanese Cultural Ethnomathematics.

RESULT AND DISCUSSION

Result

The learning model book was prepared to serve as a guide in implementing learning models that are carried out online, especially during the Covid-19 pandemic (Sadikin & Hamidah, 2020). The learning model refers to the inquiry learning model based on Javanese cultural ethnomathematics. The learning model book that is compiled contains two sub-titles. The first sub-heading is a theoretical study related to inquiry learning models (definition of learning models, understanding of inquiry learning models, basic concepts of inquiry learning, principles of inquiry learning, steps of inquiry learning models, inquiry learning objectives), online mathematics learning in the 4.0 era, ethnomathematics, and Javanese Culture ethnomathematics. The second subtitle relates to learning models, which include learning model syntax, social systems, learning principles, learning support systems, instructional impacts, and accompanying impacts. (Pandey, et al., 2011).

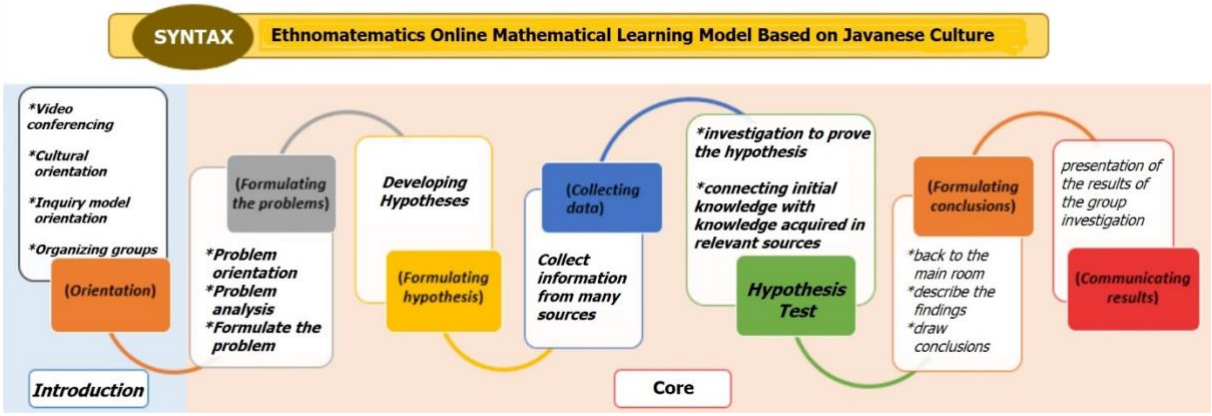

Figure 1. Learning Model Syntax

The model of learning mathematics through Ethnomathematics is a form of culture-based learning in the context of mathematics (Rosa & Orey, 2011). The ethnomathematics learning model through Javanese Culture, noble values can be obtained that can be used as a universal source of character education (Santoso et al., 2020). This model applies inquiry learning, which is a learning model that gives students relevant experiences, helps them apply the scientific method, and trains and develops relevant skills. Inquiry learning allows students to build knowledge independently, helps them understand representative concepts, and trains their scientific literacy (Endang et al., 2021). An example of an online mathematical inquiry learning model based on Javanese Culture ethnomathematics is shown in Figure 2.

(a) (b) (c)

Figure 2. (a) Learning Model Book (b) Learning Module (c) Student worksheets

Implementation of research in the second year focused on testing the model on users, namely students and teachers. Tests were carried out on 12 junior high schools in Yogyakarta Province, Central Java Province, and East Java Province. The evaluation aspect relates to the stages of development research to improve the product development. Evaluation aspects in the form of suggestions obtained from teachers as users are used for products that have been developed. The results of the preliminary aspect assessment have an average of 4.17 (See Table 2). The results of the content aspect assessment have an average of 4.17. The assessment results of the evaluation

aspect have an average of 4.08. The results of the closing aspect assessment have an average of 4.21.

Table 2. Assessment of Learning Modules by Users

School	Introductory Aspect	Content Aspect	Evaluation Aspect	Closing Aspect
SMP Negeri 9 Yogyakarta	4.00	3.70	4.00	4.00
SMPN 1 Mlati Sleman	4.75	4.10	4.67	4.00
SMP Taman Dewasa Ibu Pawiyatan	4.00	4.40	4.33	4.00
SMP Muhammadiyah 6 Manisrenggo	4.25	4.10	4.00	4.00
SMP Negeri 2 Prambanan Klaten	3.75	4.00	4.33	4.00
SMP Negeri 1 Donorojo, Pacitan	4.50	4.40	4.00	4.50
SMP PGRI Gendaran, Donorojo, Pacitan	4.50	4.60	3.50	4.50
SMP Negeri 4 Depok	4.50	4.00	4.17	4.00
SMP Negeri 5 Baguntapan	4.00	4.30	3.50	4.50
SMP Negeri 1 Kota Mungkid	4.25	4.10	3.83	4.00
SMP Negeri 1 Mungkid	4.00	4.30	4.17	4.50
SMP Negeri 2 Muntilan	3.50	4.00	4.50	4.50
Average	4.17	4.17	4.08	4.21

User ratings of worksheets developed based on linguistic aspects obtained an average of 4.17. It means that the language used in the module is easy for students to understand and has clear instructions or instructions. The results of the assessment of the completeness aspect of the worksheet components have an average of 4.21, indicating that there is clarity in providing examples of activities and questions that can help strengthen understanding of the concepts contained in the material. The assessment results of the content and material aspects have an average of 4.08, indicating complete accuracy of the content and learning materials. The assessment results of the suitability aspect of the learning model requirements have an average of 4.23, indicating that there are worksheets following predetermined conditions.

Table 3. Results of Assessment of Worksheets by Users

School	Worksheet Component Completeness	Appropriate Content and Material	Language	Appropriateness of the learning model requirements
SMP Negeri 9 Yogyakarta	3.75	4.17	4.00	3.50
SMPN 1 Mlati Sleman	3.75	4.00	4.00	4.50
SMP Taman Dewasa Ibu Pawiyatan	4.50	3.83	4.67	4.00
SMP Muhammadiyah 6 Manisrenggo	4.00	4.00	4.00	4.00=
SMP Negeri 2 Prambanan Klaten	4.00	3.83	4.33	5.00
SMP Negeri 1 Donorojo, Pacitan	4.50	4.00	4.33	4.00
SMP PGRI Gendaran, Donorojo, Pacitan	4.00	4.00	4.00	4.50
SMP Negeri 4 Depok	4.50	4.67	4.67	4.50
SMP Negeri 5 Baguntapan	4.25	4.17	4.00	4.00
SMP Negeri 1 Kota Mungkid	4.75	4.33	5.00	5.00
SMP Negeri 1 Mungkid	4.25	3.83	4.00	3.50
SMP Negeri 2 Muntilan	4.25	4.17	3.00	4.00
Average	4.21	4.08	4.17	4.23

Discussion

The application of the Javanese cultural ethnomathematics-based inquiry learning model shows excellent results. It is evidenced by the assessment of twelve schools taken from junior high schools originating from the Yogyakarta Provinces, Central Java, and East Java. Users state that they understand the learning model developed, including learning model syntax, social systems, learning principles, learning support systems, instructional impacts, and accompanying impacts. This learning model can be the basis for developing teaching materials that relate to everyday life and can lead to positive character.

The Javanese ethnomathematics-based inquiry learning model book was prepared to serve as a guide in implementing online learning models, especially during the Covid-19 pandemic. However, because learning has returned to offline, inquiry learning based on Javanese ethnomathematics culture can be carried out offline based on predetermined syntax with several assessments. Suggestions recommended by users are that it is necessary to add offline-based learning syntax and be given colorful pictures so that it is attractive to students. This model is great for finding answers on your own or making it more self-sufficient for students interested in math. However, it is different for less interested students who need guidance. The advantages of this book are that it is packaged in light language, is easy to understand, and has a coherent explanation. The book has been arranged systematically to make it easier for readers to understand its contents, from theoretical studies on learning mathematics in general to learning mathematics based on Javanese ethnomathematics online.

The module here is one of the media that can be used to support the application of an inquiry learning model based on Javanese ethnomathematics culture. Learning modules are suitable for use based on the results of assessments carried out in twelve schools. The user ratings of the learning module show high scores in the introductory, content, evaluation, and closing aspects. Users explain that the modules provided are complete and the material in them can be understood clearly, the language used is easy to understand, and the contents are concise. The suggestions recommended by the user are that various examples of traditional children's games can be added, complete pictures explaining the material, and elements of Javanese culture can be included in the comprehension test questions.

The learning module is combined with inquiry learning based on Javanese ethnomathematics culture to make the learning atmosphere more conducive and exciting and hone students' abilities. This module has been assessed to determine the feasibility level. This assessment is carried out with the aim of making decisions in revising and developing learning modules. This module is helpful for supporting mathematics subjects so that students can use basic knowledge of mathematics in everyday life and as a basis for independently developing competence. Through modules, students learn not to depend on other people because the learning material studied is contained in one module.

The results for the worksheet assessment are good, including aspects of the completeness of the worksheet components, content and material suitability, and language and learning model requirements. The complete worksheet component provides clear examples of activities and

questions that can help strengthen understanding of the concepts contained in the material. The contents and materials are presented in full. The language used is straightforward and can be easily understood by users. The level of conformity with the requirements of the learning model is also high. Users explain that the worksheet provides explicit instructions, the activities are student-centered, following the learning objectives in the lesson plan, and there are steps in accordance with the learning syntax. Suggestions recommended by users are related to grammar to make it easier to read, it is necessary to add questions that train students' literacy and numeracy skills, and there is an adjustment between the time needed for students to implement activities in worksheets with the time allocation in the lesson plan.

The development of inquiry learning products based on Javanese ethnomathematics culture makes a very good contribution to be applied when the learning process with an inquiry model based on Javanese cultural ethnomathematics takes place and can be used as material for consideration in the implementation of the mathematics learning process. Through an ethnomathematics-based Javanese cultural inquiry learning model that is applied in accordance with the characteristics of mathematics lessons, the conditions, and the needs of students, it is hoped that learning activities and outcomes can be further optimized.

CONCLUSION

The research results show that the learning model's development stage achieved the design stage. The achieved result is conducting the observation in schools and field observation to the 10 Javanese Cultural sites. Hence, the focus group discussion obtained the syntax of the ethnomathematics-based online inquiry learning model. The inquiry learning model's syntax is orientation, formulating the problem, formulating a hypothesis, collecting data, testing the hypothesis, formulating conclusions, and communicating results. The syntax of the inquiry learning model guides the development of an online inquiry learning model book based on Javanese Culture ethnomathematics. The learning model book is declared valid and feasible to use.

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