



Ethnomathematics-Based Learning Tools

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ABSTRAK

Penerapan sistem belajar dari rumah (BDR) serta pemberlakuan social distancing menuntut guru untuk mengembangkan sumber pembelajaran matematika dengan memanfaatkan lingkungan yang dekat dengan keseharian siswa. Namun masih banyak guru yang kesulitan dalam mengembangkan sumber belajar yang cocok diterapkan oleh siswa. Tujuan penelitian ini adalah merancang perangkat pembelajaran berbasis etnomatematika yang valid, praktis dan efisien dengan memanfaatkan Pawon (dapur) sebagai sumber belajar. Perangkat pembelajaran dirancang dengan memodifikasi prosedur pengembangan Borg dan Gall, yaitu eksplorasi, perencanaan, pengembangan, revisi awal, uji coba terbatas, revisi akhir, dan diseminasi. Perangkat pembelajaran yang telah dikembangkan selanjutnya divalidasi oleh expert media, materi, dan expert budaya yang selanjutnya diujicobakan kepada 3 orang guru dan 12 siswa. Instrumen pengumpulan data berupa lembar eksplorasi dan angket. Teknik analisis dilakukan melalui analisis deskriptif kuantitatif dan kualitatif. Hasil penelitian yaitu rancangan perangkat pembelajaran yang dikembangkan memenuhi kriteria valid ditunjukkan dari persentase penilaian oleh ahli materi, ahli media, praktisi, dan pakar budaya Kabupaten Kulon Progo yang mencapai hampir 100%, kriteria kepraktisan berdasarkan penilaian oleh guru dan siswa yang termasuk dalam kategori sangat baik, serta kriteria efektif berdasarkan penilaian acuan kriteria dimana terdapat lebih dari 75% siswa yang memperoleh nilai di atas kriteria ketuntasan minimal (KKM). Hasil pengembangan perangkat pembelajaran berbasis etnomatematika memenuhi kriteria valid, praktis, dan efektif digunakan dalam pembelajaran matematika siswa sekolah dasar.

ABSTRACT

The application of the learning from the home system (BDR) and the implementation of social distancing require teachers to develop mathematics learning resources by utilizing an environment close to students' daily lives. However, there are still many teachers who have difficulty developing learning resources that are suitable for students to apply. This study aimed to design a good, practical, and efficient ethnomathematical-based learning device by utilizing Pawon (kitchen) as a learning resource. Learning tools are designed by modifying the Borg and Gall development procedures, namely exploration, planning, development, initial revision, limited trial, final revision, and dissemination. The learning tools developed are then validated by media, material, and cultural experts, which are then tested on three teachers and 12 students. Data collection instruments in the form of exploration sheets and questionnaires. The analysis technique was carried out through quantitative and qualitative descriptive analysis. The study results are that the design of the learning device developed meets the valid criteria as indicated by the percentage of assessments by material experts, media experts, practitioners, and cultural experts in Kulon Progo Regency, which reaches almost 100%. Practicality criteria based on assessments by teachers and students included in the excellent category and effective criteria based on the criteria reference assessment, more than 75% of students get scores above the minimum completeness criteria (KKM). The results of the development of ethnomathematical-based learning tools meet the criteria of being valid, practical, and effective for use in learning mathematics for elementary school students.

1. INTRODUCTION

The Covid-19 pandemic has affected education systems worldwide, leading to the complete closure of schools, institutions, and colleges (Dong et al., 2020; Sari et al., 2020; Shirish et al., 2021). As of mid-April 2020, some 1.723 billion students had been affected by school closures in response to the pandemic. School closures not only impact students, teachers, and families but have far-reaching economic and social consequences (Alsoud & Harasis, 2021; Mustafa & Zahoor, 2020). School closures in response to COVID-19 have changed the form of face-to-face learning activities, shifting to digital forms of learning and the internet (Choi et al., 2021; Maatuk et al., 2021). In response to school closures, the Ministry of Education and Culture recommends the use of distance learning programs and open educational applications and platforms that schools and teachers can use to optimize student learning processes (Aji, 2020; Mustakim, 2020). In this case, the Ministry of Education and Culture of the Republic of Indonesia has partnered with various parties to provide digital learning platforms, which number more than ten digital platforms, to support the distance

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learning process. The next problem is the learning process of students with economic limitations, so they have not been able to provide digital learning support facilities (Aji, 2020; Mastura & Santaria, 2020; Sadikin & Hamidah, 2020). Previous research revealed that one of the difficulties students face during the application of online learning was the emergence of educational equity gaps due to economic factors (Nurkholis, 2021; Windhiyana, 2020). The difficulties encountered are in the form of learning disorders due to limited economic capacity, namely, not all students have smartphones and the absence of special funds for online learning (Alchamdani et al., 2020). In addition to economic problems, another problem is the unavailability of a stable internet network (Aini et al., 2020; Hamid et al., 2020).

The results of interviews and researchers' sharing with several school mathematics teachers in the Temon Kulon Progo area by telephone obtained information that during the Covid-19 pandemic, the student learning process was carried out through the Whatsapp Group (WAG) platform and virtual gatherings through a digital classroom platform. The same thing was found in research that states that teachers' online platform models in learning include WhatsApps (WA), Google Forms, Google Classroom, Google Drive, Youtube, WA groups, Tuweb, and some even have face-to-face meetings with the Zoom application twice a week. Meeting (Anugrahana, 2020; Guswara, 2020). Even though not all students have sufficient economic ability and live in affordable areas by stable internet, they can provide learning facilities with digital platforms. Therefore, teachers need to develop learning materials that can bridge students' differences in providing learning facilities. Through further interviews, data was obtained that in the learning activities, students were provided with worksheets that could be used for one semester and could be purchased in general. The worksheets that students have used have not been able to bridge the implementation of social distancing-based mathematics learning with the approach to the characteristics of the students' closest environment. Teacher creativity is needed in providing mathematics learning tools that can overcome these problems.

Utilizing students' immediate environment as a learning resource will indirectly integrate students' environmental culture into learning (Bernardus et al., 2013; Rohmanurmeta & Dewi, 2019; Windiani et al., 2017). This integration can be realized in the form of ethnomathematics-based mathematics learning tools (Hariastuti, 2019; Utami et al., 2018). Ethnomathematics-based learning uses local culture as the primary learning resource (Bito & Fredy, 2020; Nur et al., 2021). The process of learning mathematics cannot be separated from the characteristics of students' interaction with their social environment (Bito & Fredy, 2020; Nur et al., 2021). One of the neighborhoods that are close and very accessible to students is Pawon. Pawon is a term in Javanese for residents in Yogyakarta to refer to the kitchen. Every household must have Pawon, and in their daily activities at home, students must involve Pawon. The use of Pawon as an ethnomathematical-based learning resource is supported by previous research, which states that the equipment in the kitchen is a regional culture that contains cultural values and is still developing or used by the community (Suranny, 2015).

Many ethnomathematical studies have been conducted, and research focuses on the development of media, teaching materials, and learning tools (Chrissanti, 2019; Ishartono & Ningtyas, 2021). Previous studies that have been conducted reveal that the use of media, teaching materials, and learning tools can increase the meaningfulness of the learning experience so that it affects motivation, interest, increased learning outcomes, increased problem-solving abilities, and can improve student character (Mania & Alam, 2021; Paroqi et al., 2021; Patria & Heswari, 2021). The difference between this study and previous research is the use of the Pawon (kitchen) element as a learning resource and the learning steps that are arranged according to the social distancing program. In this study, ethnomathematics-based learning tools in elementary schools are special learning tools prepared or made as a design for mathematics learning activities by adopting and adapting the local culture around students as a learning resource.

Based on the description above, the development of thematics-based learning tools during the covid pandemic is essential to accommodate the learning process that reaches all students who have different levels of financial ability, accommodate students whose homes are not accessible to the internet, create a meaningful learning process, and contribute to preserving the original culture of Kulon Progo Regency. Elementary school teachers currently use LKS as a learning tool, but the LKS used are still very general, do not refer to social distancing activities, and have not focused on the characteristics of the student environment. It encourages researchers to design learning tools that are valid and suitable/for the Covid-19 pandemic situation but do not provide much economic burden for students and their families. In developing the device, researchers will explore using an ethnomathematical approach by utilizing the environment around students, namely Pawon or the kitchen in students' homes in Kulon Progo Yogyakarta..

METHOD

The development model used in this research is the design proposed by Borg and Gall, which has been modified and adapted to the research objectives. In the Borg & Gall research stage, they can take the

steps according to their individual needs, conditions, and costs, but it is advisable to discuss gathering information, developing according to principles, evaluating and testing products. The development procedure in this study is divided into seven development procedures, namely exploration, planning, development, initial revision, limited trial, final revision, and dissemination. (Aka, 2019). The population in this study were all public elementary schools in Kulon Progo Regency, as many as 277 elementary schools. The sample in this study was taken by stratified sampling with sampling based on the sub-district area, which was then carried out by random sampling so that as many as 12 elementary schools were obtained as samples. The data analysis techniques in this study were divided into four, namely preliminary studies, product development processes, product practicality tests, and product effectiveness tests. Preliminary study data were analyzed descriptively. The data obtained from this study are in the form of quantitative and qualitative data. Data collection techniques used are observation, documentation, questionnaires, and tests. Observations and documentation were carried out at the exploration stage to obtain information about sources of ethnomathematical literacy in Pawon, housewives of the Kulon Progo Regency, Yogyakarta. The data obtained at this stage is qualitative. While the questionnaire was not only used during exploration, it was also used at the validation stage and small group testing to determine the practicality of the product being developed. The test is used to determine the level of effectiveness of the product. The data obtained from the questionnaire and test instruments are quantitative.

The grids included in the media expert validation instrument include aspects of paper size on the module, module skin design, and module content design. The grid on the material validation instrument includes aspects of conformity with KD, compatibility with teaching materials, the truth of the substance of learning materials, usefulness, linkage of material with Pawon, motivation, conformity with language rules, and ease of understanding sentences. The grid on the instrument validation of syllabus and lesson plans includes identity, core, essential competencies, subject matter, learning implementation, assessment, time allocation, and learning resources. In the practicality test instrument, the teacher grid includes aspects of content clarity, the attractiveness of appearance, ease of use, ease of language to understand, clarity of information, conformity with K 13, the correctness of material content, usefulness for learning, and economic value. The grids used in the student practicality test instrument include interest in devices, presentation of ethnomathematical aspects, interest in devices, clarity in writing, ease of understanding, presentation of devices, and device design. In the instrument of conformity to the culture of Kulon Progo district, the grid used includes aspects of ethnomathematical-based development elements, the suitability of ethnomathematical objects used, the truth of ethnomathematical objects, ease of use of ethnomathematical learning tools. The data obtained from material experts, media, practitioners, and cultural experts of Kulon Progo Regency were then processed into two categories, namely valid (score 1) and invalid (score 0). The steps used to determine the criteria for the validity of the device are (1) the data in the form of scores obtained from experts through the validation sheet are summed; (2) the total score obtained by each learning device is said to be valid if the minimum validity is in good criteria. Data on the practicality of the device was then collected based on the product being developed. The analysis is continued by determining the final average of the data obtained and determining product categories according to practicality criteria. Each learning device is practical if the teacher's assessment is at least in good criteria and at least 75% of students give LKPD assessments in the excellent category.

The following data analysis is the implementation of learning. This assessment is obtained through observation of the implementation of learning. The observation is in the teacher's ability to manage learning and student activities during the learning process. The assessment sheet used is an observation sheet consisting of 22 statement items. The observer's answer choices will be converted to 1 (one) for the answer choice of "yes" and 0 (zero) for the answer "no," then converted into qualitative data based on the reference in Table 1. The implementation of learning can be practical if each meeting is at least in the excellent criteria or the percentage of learning implementation exceeds 80% or at least is in the excellent category. In this study, the determination of the effectiveness of the learning device is based on the criteria reference assessment. In this study, the learning device is effective if at least 75% of students get a minimum score in the excellent category (B), reaching the Minimum Completeness Criteria (KKM), which is 75. In this study, the reliability calculation used was the Cronbach's Alpha procedure.

2. RESULT AND DISCUSSION

Result

Ethnomathematical exploration activities were carried out through direct observation and distributing survey questionnaires to find out ethnomathematical sources in kitchen utensils in Pawon, households in Kulon Progo Regency. In this exploration stage, the researchers distributed 30 surveyors and distributed survey questionnaires to the field or Pawon households in the Kulon Progo Regency community.

Each surveyor is tasked with taking survey samples from 5 household kitchens in the Kulon Progo Regency and five samples from the household kitchens of elementary school students in the Kulon Progo Regency. At the planning stage, the researcher conducted a Focus Group Discussion (FGD) with the research team to collaborate on the findings of ethnomathematical objects with the learning and learning process in elementary schools. The planning stage includes general and specific planning. General planning includes studies and adjustments to ethnomathematics in Pawon households in Kulon Progo Regency, the nature of mathematics in elementary schools, characteristics of elementary school students, various learning methods that can be applied in elementary schools, assessment methods for elementary school students, learning resources that can be used in elementary schools. Relevant, as well as studies on the steps of developing learning tools. The unique preparation includes curriculum analysis (K-13) in elementary schools, which includes an analysis of content standards, core competencies, competency standards, essential competencies, learning objectives, mapping, assessment indicators, teacher books, and student books. The final result of the planning stage is the initial design of an ethnomathematics-based learning device with the learning resources used coming from the Pawon community of Kulon Progo Regency. The initial design of the syllabus is 3 (three) products, the initial design of the RPP is 10 (ten) products, the initial design of the LKPD is 3 (three) products, and the initial design of evaluation questions is 3 (three) products.

The development phase begins with the validation of material experts, media, practitioners, and cultural experts of Kulon Progo Regency against the initial design produced. The syllabus, lesson plans, and evaluation questions were validated by giving the initial product design script and validation instruments to expert judgment, namely one material expert, three practitioners, and one cultural expert in Kulon Progo Regency. Validation of the LKPD is done by giving the initial product design script and validation instruments to expert judgment, namely one material expert, one media expert, three practitioners, and one cultural expert in Kulon Progo Regency. After all the validation data has been collected, a revision is made to the learning device product based on the assessments and suggestions of expert judgment.

The assessment results, suggestions, and input from expert judgment (1 material expert, one media expert, three practitioners, and one cultural expert from Kulon Progo Regency) were used to evaluate and improve the products developed. As for suggestions and input from expert judgment regarding improving the syllabus, namely improving the format, the appointment of ethnomathematical steps in more detail, and allocating a balanced time. In the revised RPP, the need for additional apperceptions about activities in Pawon (kitchen) and an ethnomathematical orientation in core and essential competencies. In the LKPD device, the revisions carried out were reducing images, improving the concept of geometric shapes according to the nature of geometric shapes, and adjusting writing according to good and correct Indonesian according to EYD (Enhanced Spelling). The evaluation tool was revised by adding contextual photos. Based on the summary of suggestions and input from expert judgment, the product developed was revised so that the product revision results were obtained according to the suggestions and inputs obtained. Based on the expert judgment assessment, the Pawon mother's ethnomatics-based learning device for grade 4 is in excellent and valid criteria with a syllabus validity value of 4.34, RPP with a validity value of 4.78, LKPD with a validity value of 57.65, and evaluation questions with the validity value is 50.00. The assessment of the validity of the Pawon mother ethnomatics-based learning device for grade 5 is in very good and valid criteria with a syllabus validity value of 4.43, lesson plans with a validity value of 4.71, LKPD with a validity value of 57.37, and evaluation questions with a validity value 51.25. The assessment of the validity of the Pawon mother's ethnomatics-based learning device for grade 6 is in very good and valid criteria with a syllabus validity value of 4.59, lesson plans with a validity value of 4.80, LKPD with a validity value of 56.61, and evaluation questions with a validity value 50.00.

The implementation of product trials is carried out through limited trials and broader trials. A limited trial was conducted to determine the practicality and effectiveness of the product. In its implementation, this trial involved 18 students in grades 4, 5, and 6 from 2 elementary schools in the Kulon Progo district and 6 partner teachers as assessors of the device's practicality. The trial students conducted a practical assessment of the LKPD while the teacher assessed the syllabus, lesson plans, LKPD, and evaluation questions instruments. A more comprehensive trial was conducted to determine the effectiveness of the product. This trial involved 54 students and 18 teachers (9 teachers teaching and 9 teachers as observers) from 3 elementary schools in Kulon Progo Regency. Assessment of the product's effectiveness is obtained by filling out the implementation of learning instruments by observers and teachers, assessing the readability of LKPD, and assessing student learning outcomes from evaluation tests filled out by students. The practicality of learning devices operationally in the field is known after the devices are implemented in the learning process. Practical information was obtained from learning observation activities, teacher assessments, and student assessments of LKPD. The results of the practicality assessment by teachers and students on the syllabus, lesson plans, LKPD, and evaluation questions for grades 4, 5, and 6 are in the practical category. The effectiveness of learning devices can be seen from the

data analysis of student learning outcomes using the developed product. The test results of the effectiveness of learning devices for grades 4, 5, and 6 obtained an average percentage of completeness, respectively, which is 90.83% for grade 4 students and 86.67% for grade 5 82.5% for grade 6 students. Because the completeness of student learning outcomes in each class has exceeded 75%, it can be concluded that the device has met the effective criteria. Based on the reliability analysis conducted on the knowledge and skills test instrument using Cronbach's Alpha, the instrument reliability value was 0.81, which was included in the high category, which means that the test instrument can be trusted as a measurement tool on learning outcomes. Obtaining data from limited trials (practical and product effectiveness) is then used to improve learning device products. The results of the final revision are the syllabus, lesson plans, LKPD, and evaluation questions that are valid, practical, and effective.

Dicussion

The learning device products produced in this study have met the valid, practical, and effective criteria for elementary school mathematics learning, especially in the current COVID-19 pandemic. It is based on the assessment of material experts, media experts, cultural experts, practicality tests, and tests of the device's effectiveness on students. From these results, it can be understood and interpreted that the development of ethnomathematical-based learning by utilizing Pawon as a student learning resource can support the student's mathematics learning process during the COVID-19 pandemic. The application of steps to obtain meaningful learning for students has been compiled and included in the learning steps through ethnomathematics-based learning tools in Pawon Ibu so that the resulting devices are effectively applied in learning. The learning process at home will be optimal if the teacher provides a more challenging and exciting learning experience, for example, observing, experimenting, and analyzing (Dong et al., 2020; Shirish et al., 2021; Wahyono et al., 2020). The LKPD in the device was developed with the guided discovery method designed for learning steps that involve concrete objects familiar to students' daily lives (Marshel & Ratnawulan, 2020). It becomes exciting and challenging when students are asked to make observations, experiments on concrete objects. LKPD combined with guided discovery can encourage students to think independently to find general principles based on materials or data provided by the teacher and practice understanding skills using systematic steps (Anggriani et al., 2020; Atiyah et al., 2020; Yuliani et al., 2018). From the description above, learning which is usually done through giving assignments through the WA and LKS platforms, through this learning tool has been changed to contextual learning that is scientific. By research that has been done, the use of media with concrete objects that exist in students' daily lives will make mathematics learning meaningful, help students understand the material, and improve learning outcomes (Crismono, 2017; Setyowati & Masrukan, 2016). Many studies on ethnomathematics and the development of ethnomathematical tools have been carried out (Cimen, 2014; Mania & Alam, 2021; Verner et al., 2019). The learning device developed in this study refers to the guided discovery method while still applying the rules of the social distancing program. From Pawon (kitchen), many mathematical objects, especially geometric objects, can be used as sources for ethnomathematical learning by students. Ethnomathematics objects are all cultural objects that contain mathematical concepts in a particular society; ethnomathematics for students aims to facilitate mathematical understanding integrated into local wisdom (Putra & Mahmudah, 2021). The use of concrete objects in the kitchen can not only make mathematical activities meaningful but also as a means to introduce students to their own local culture. This statement is supported by several previous studies on ethnomathematics to recognize and preserve local culture (Akib, 2016; Nur et al., 2020; Bito & Fredy, 2020; Prahmana & D'Ambrosio, 2020).

The validity, practicality, and effectiveness of the learning tools developed in this study are supported by the characteristics of the development of good learning tools and have been adapted to the nature of mathematics in elementary schools, the characteristics of elementary school students, various learning methods that can be applied in elementary schools, assessment methods for elementary school students, relevant learning resources, studies on the steps for developing learning tools and through the curriculum analysis process (K-13) in elementary schools, which includes an analysis of content standards, core competencies, competency standards, essential competencies, learning objectives, mapping, indicators, assessments, teacher books, and student books. Obtaining the validity, practicality, and effectiveness of these learning tools is by previous research on matters that need to be considered in the preparation of learning tools (E. Akib et al., 2020; Choirudin et al., 2020; Gunawan, 2017). The resulting learning devices can make students more interested in learning because the learning steps on the device are arranged starting from the real world of the daily world of students. Through Pawon learning resources indirectly, students also learn about their culture. It is essential to instill cultural values early on in each individual. The goal is that students can later become a generation of character and maintain and preserve culture as the foundation of the nation's character (Chrissanti, 2019; Khuriyah et al., 2017). Apart from

being an alternative form of cultural cultivation, ethnomathematics is also a bridge between mathematics and culture that can provide students with a more meaningful learning experience (Hayuhantika, 2019).

From the description above, the ethnomathematics-based learning device utilizing the pawon (kitchen) as a learning resource is an effective tool for elementary school students, especially during the current Covid-19 pandemic. Pawon that is presented or appointed as a learning resource is a distinguishing element between this study and other research. Concrete objects as student learning resources are available near students, without students having to try to get them by buying or making direct contact with people or the surrounding environment. It is by implementing the learning from home program and obedience to comply with social distancing. This learning device product can be applied by teachers in elementary schools as an additional reference for teaching during the Covid-19 pandemic, adding to the insight of teachers in developing teaching materials that can accommodate students' economic limitations in presenting online learning tools.

3. CONCLUSION

The resulting learning tools can present meaningful, practical, and effective learning processes and experiences for students to be applied to elementary school students. In addition, ethnomathematical-based learning tools can accommodate students' limitations in providing online learning facilities, and the steps used in learning have referred to social distancing protocol regulations.

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