Development of Ethnomathematics-Based Online Learning (POBE) for Prospective Teachers

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Abstract. This study aims to develop an ethnomathematics-based online learning application (POBE) in universities. This research is an R&D which aims to design a model or product. This research procedure is limited to a POBE trial to a group of prospective primary school teachers from the primary school teacher education study program from a public university in the province of Riau, Indonesia. The data used are in the form of documentation studies and FGDs. The research implementation follows the research framework. *First*, the problem and potential analysis stage. *Second*, the stage of conducting theoretical studies, literature studies and documentation. *Third*, the stage of observing the research object and designing a development framework. *Fourth*, the initial product design stage and validity test. From the results of product validity and based on expert input and prospective primary school teachers assessments, a revision was made to the product developed in order to get a final product to be used in lectures.

Keywords: elementary school · ethnomathematics · online learning · geometry and measurement

1 Introduction

Online learning is an educational innovation that involves elements of information technology in learning using the internet network with accessibility, connectivity, flexibility, and the ability to bring up various types of learning interactions that are carried out by utilizing digital devices and the internet to make learning more interesting, creative and effective. Independent which includes the delivery of materials and information, assignment and active interaction [1–3]. With the interaction between the elements of the basic functions of information technology, online learning can be carried out. [4] found that online learning is a learning system that is not done face-to-face, but uses a platform that can help the teaching and learning process that is carried out even though it is far

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away. The platforms or applications that can be used include college online applications, google classroom, google meet, zoom, webex, whatsapp and others with a lecture system in the form of giving independent and structured assignments to students. [5] state that ethnomathematics is a research program that focuses on the relationship between mathematics and culture. The main idea is that mathematics is the product of socio-historical and cultural processes that have been developed with contributions from various societies and cultures. Ethnomathematics can bridge between culture and mathematics is ethnomathematics [6, 7]. In addition, mathematics and culture are also two things that are closely related and can explain each other and are an integral part of the cultural heritage of mankind [8, 9]. The relationship can be in the form of efforts to express mathematical ideas from the culture of society and the application of mathematics in solving problems in everyday life. The concept of ethnomathematics proposed by D'Ambrosio views culture and mathematics as two interrelated things that can be explained to each other through the daily activities of the mathematical community [10–12]. Thus, the ultimate goal of using ethnomathematics in higher education does not always end in formal mathematical knowledge and mathematical thinking skills, but instead emphasizes building a cultured personality. The cultured person is shown through an appreciative attitude towards his own culture and critical thinking to reconstruct mathematics in culture to be relevant to the times.

From some of these explanations, it can be synthesized that online learning is a conceptual framework that is used as a guideline that allows a person or group of people to try to act on a learning system that is not done face to face, but uses applications that can help the teaching and learning process that is carried out even though it is far away. in the form of educational innovations that involve elements of information technology in learning using the internet network with accessibility, connectivity, flexibility, and the ability to bring up various types of learning interactions through the use of digital devices and the internet to make learning more interesting, creative and independent to reach target groups massive and wide.

In this study, the focus is on developing ethnomathematics-based online learning applications (POBE) for student lectures in universities. This study aims to develop POBE ethnomathematics-based online learning applications in higher education by answering the research question, namely how to develop POBE applications for PGSD student lectures in higher education?

2 Methods

This study uses research and development (R & D) research methods which were adapted from [13]. This research is a research method that aims to design a model or product in the field of education and then test the effectiveness and efficiency of using the model or product. This research procedure is limited to a POBE trial with PGSD FKIP students, Riau University. The research flow chart is shown in Fig. 1.

The object of this research is ethnomathematics-based online learning (POBE) for PGSD student lectures in higher education. The POBE validity test is carried out by experts or experts in the fields of media, culture, and mathematics. The trials in this study were conducted on students of PGSD FKIP Riau Islamic University (UIR) and

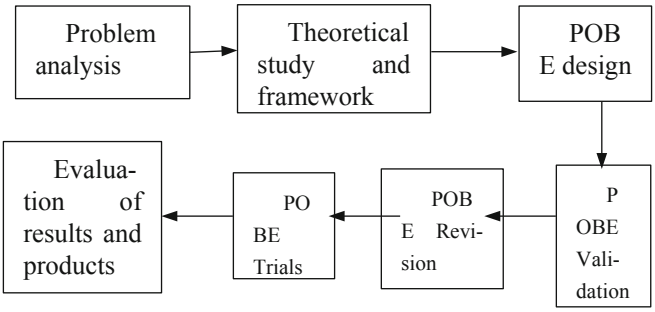

Fig. 1. POBE research and development flowchart

students of PGSD FKIP Riau University (UNRI). Meanwhile, the POBE evaluation was carried out on 42 PGSD FKIP students at the University of Riau in elementary mathematics learning courses in the odd semester of the 2022/2023 academic year.

The data used in this research are in the form of documentation studies and FGDs. Documentation study is a data collection technique used to obtain information about Riau Malay culture. This technique is done by reading several books related to Riau Malay culture in the library, then synthesizing the information obtained and taking important things that are in accordance with learning mathematics in elementary school. Meanwhile, FGDs were conducted with experts or experts to find out their opinions about ethnomathematics-based online learning (POBE) for PGSD student lectures. This was useful for obtaining information about the quality of the POBE application developed.

3 Results and Discussion

At the problem and potential analysis stage, the researcher collected information from the results of previous studies related to the mathematical abilities of PGSD students. As explained in the introduction, PGSD students have low mathematical abilities so that they have difficulty when asked to explain mathematical concepts to students, so it is necessary to develop a lecture learning model to improve the mathematical literacy skills of PGSD students. The next step is to conduct theoretical studies, literature studies and documentation. At this stage, the researcher examines several aspects, related to the POBE that will be developed. The main aspect is related to the mathematical topics that will be presented in the POBE. The step that will be taken is to examine what concepts must be mastered by PGSD students so that they are able to teach geometry and measurement in elementary schools well. At the initial stage, the researcher designed the POBE for geometry and measurement materials. After the initial POBE design was completed, the researcher conducted a validity test. The researcher asked two experts to rate the quality of the POBE developed. Aspects that will be validated include the use of language in POBE, clarity of instructions and conformity with lecture material. From the results of the validity of the POBE application design and the suggestions of experts, the researchers revised the POBE application. After that, the research continued with the POBE trial phase with 2nd year students of the PGSD study program at universities in Riau province. To see the effectiveness of the developed POBE, the students were given

questions about geometry and measurements before and after the lecture using POBE. The last stage in this research is the evaluation of the implementation of lectures using POBE.

The research implementation follows the research framework in Fig. 1. At the problem and potential analysis stage, the researcher collects information from the results of previous studies related to the problems encountered by PGSD students. As explained in the introduction, that some of the problems of PGSD students in participating in the mathematics learning process, including material that is too dense, the speed of lecturers in delivering lecture material, lecturers who still dominate lectures, and student participation is still low, resulting in students having difficulty in learning. Mathematics and have an impact on low learning achievement.

The next step is to conduct theoretical studies, literature studies and documentation. At this stage, the researcher examines several aspects related to ethnomathematics-based online learning (POBE) which was developed by looking for various kinds of references. Furthermore, the research team consisting of three people made direct observations to the Siak Sri Indrapura Palace to see and determine the object of research in the form of artifacts in the Siak Sri Indrapura Palace. Based on these observations, the research team designed a framework for developing ethnomathematics-based online learning (POBE).

At the initial product design stage, the research team and experts discussed through focus group discussions (FGD) in making the POBE design so that it could be used by lecturers and students in lectures. After the initial design is completed, the validity test is carried out. The validity test in this study was carried out by testing the validity of experts and testing effectiveness on PGSD students Batch 2021 FKIP Riau University. For the expert validity test, the researcher asked two experts to assess the quality of the developed POBE. Meanwhile, 42 PGSD students assessed the quality of the POBE developed. From the results of product validity and based on expert input and student assessments, a revision was made to the product developed.

Related to the function of knowledge in the learning process, online learning that is mastered by prospective elementary school teachers or PGSD students has a very large contribution to all aspects of learning [14–16]. From several studies by researchers on different knowledge domains teachers use when designing and implementing learning. Therefore, ethnomathematics-based online learning is used to improve mathematical literacy skills.

The data on the results of the model component assessment in detail can be seen in the Table 1. The average score for the assessment of the model components by experts is 149. A summary of the validation results for the ethnomathematics-based online learning component can be presented in Table 1 below.

In addition to quantitative data in the form of scores, the level of validity of the POBE is also determined based on qualitative data in the form of final conclusions from the validator with an assessment of whether or not the product developed is feasible. Based on the conclusions from the two validators, they concluded that the POBE component was suitable for use with revisions. Based on the results of these conclusions, the researchers made revisions according to the input and suggestions given on the model validation sheet. The inputs and suggestions as well as the results of the revision of the POBE

Table 1. Recapitulation of validation results

Assessment Aspect	Expert Rating		Average	Validity Criteria
	1	2		
Rational Development	22	23	22,5	VG
Supporting Theory	21	22	21,5	VG
Syntax	17	17	17	VG
Social System	18	17	17,5	VG
Reaction Principle	18	18	18	VG
Support System	13	13	13	VG
Instructional Impact	13	13	13	VG
Implementation Instructions	27	26	26,5	VG
Total Score Rating	149	149		
Average Rating	149		Very Good (VG)	

component from each validator are explained in the section on the revision of the model components.

The POBE application assessment instrument which has been declared valid by the experts, then its reliability is estimated using the Alpha Croanbach formula. The assessment instrument for the POBE application component obtained a reliability coefficient of 0.931. This shows that the POBE application assessment instrument is reliable and can be used to collect data. The trial of the POBE product that has been developed is the third stage of development, namely the assessment phase. The activities carried out at this stage are implementing online learning for PGSD student learning to improve mathematical literacy skills. The field trial activity was carried out in August 2022. After the field trial was completed, it was continued by conducting a summative evaluation to obtain data on the practicality and effectiveness of the developed model.

The effectiveness of the developed POBE can be shown from the student's achievement after attending elementary mathematics learning lectures using POBE. Prior to the implementation of elementary mathematics learning lectures using POBE, students who were the test subjects were given an initial test to determine their mathematical literacy skills. Based on the results of data analysis, the average pretest score was 57.5. The average indicates that the mathematical literacy ability is included in the fairly good category. However, if you pay attention, from individual completeness based on a minimum score of 70, it was found that only 14 students had completed (33.33%) and the rest were still below the minimum score.

After the developed model was used in elementary mathematics learning lectures, students were again given an ethnomathematics-based mathematics learning test in elementary school. This is intended to determine the increase in students' mathematical literacy skills from before attending lectures using POBE. Based on the results of the final test data analysis of mathematical literacy skills, it appears that there was an average progress from 57.5 (good enough category) to 78.9 (very good category). The increase

Table 2. Recapitulation of assessment before and after lecture

Aspect of Change	Pretest	Posttest
Completed student (CS)	14 (33,33)	35 (83,33)
Unfinished student (US)	28 (66,67)	7 (16,67)
Total score	2416	3317
Average score	57,52	78,98
Average N Gain	0,52 (Medium)	
Conclusion	Not yet effective	Effective

in mathematical literacy skills based on the N Gain value, obtained an average of 0.52 which is included in the category of moderate improvement (0.31–0.71).

Based on the information obtained from the average value of the increase in students before and after attending lectures, it can be concluded that the average mathematical literacy ability of students has increased significantly. After lectures, the number of students in the very good category increased from 14 people (33.33%) to 35 people (83.33%). In addition, the overall average score increased from 57.5 to 78.9. The recapitulation of the assessment results before and after lectures can be presented in Table 2.

Based on Table 2, it shows that the mathematical literacy ability has reached the minimum completeness limit that has been previously set, which is at least 75%. Thus, it can be concluded that the developed model is effective for improving mathematical literacy skills. With the criteria for the effectiveness of the products developed, among others are: 1) the achievement of classical learning mastery through elementary mathematics learning lectures, namely at least 75% of students achieve a minimum score of 70 for a score range of 0–100; 2) the activities carried out by PGSD students are in accordance with the minimum expected activities in the good category; and 3) more than 75% of PGSD students gave a minimal good response to lecture activities. Because the three criteria have been met, it can be concluded that the developed model is effective for improving mathematical literacy skills. Therefore, at this stage the final prototype of the POBE developed has been obtained.

4 Conclusion

Based on the results of research and discussions that have been carried out, it can produce appropriate ethnomathematical-based online learning to improve mathematical literacy skills in elementary school. Based on the results of validation (formative assessment) by experts, then revisions were made, it was concluded that the POBE product had met the valid criteria with very good criteria so that it was suitable for use by students in higher education. The ethnomathematics-based online learning developed is still at an early stage. Therefore, it still requires testing the level of effectiveness of its users in elementary schools. Input from schools, such as teachers and students, will be useful for improving ethnomathematics-based online learning before it is disseminated in schools in Riau

Province. Meanwhile, the content of mathematics and culture in ethnomathematics-based online learning still needs to be analyzed more deeply in order to determine the quality of the ethnomathematics-based online learning (POBE) developed.

References

1. Moore, J. L., Dickson-Deane, C., & Galyen, K. (2011). E-Learning, online learning, and distance learning environments: Are they the same? *Internet and Higher Education*, 14(2011), 129–135.
2. Kristina, M., Sari, R.N., & Nagara, E.S. (2020). Model pelaksanaan pembelajaran daring pada masa pandemi covid 19 di provinsi lampung. *Jurnal Idaarah*, 6(2), 200–209.
3. Fitriyani, Y., Fauzi, I., & Sari, M. (2020). Motivasi belajar mahasiswa pada pembelajaran daring selama pandemik covid-19. *Jurnal Kependidikan: Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran*, 6(2), 165–175.
4. Handarini, O.I., & Wulandari, S.S. (2020). Pembelajaran daring sebagai upaya *study from home* (SFH) selama pandemi covid 19. *Jurnal Pendidikan Administrasi Perkantoran (JPAP)*, 8(3), 496–503.
5. Albanese. V, & Perales, F.J. (2015). Enculturation with ethnomathematical microprojects: From culture to mathematics. *Journal of Mathematics and Culture*, 9(1), 1–11.
6. Wahyuni, et al. (2013). *Peran etnomatematika dalam membangun karakter bangsa*. Makalah dipresentasikan pada Seminar Nasional Matematika dan Pendidikan Matematika FMIPA UNY. ISBN: 978–979–16353–9–4. 113–118.
7. M. Fendrik, Marsigit, and M. N. Wangid, "Analysis of Riau traditional game-based ethnomathematics in developing mathematical connection skills of elementary school students", *Elementary Education Online*, vol. 19 no. 3, pp. 1605–1618, 2020.
8. Barta, J., & Shockey, T. (2006). The mathematical ways of an aboriginal people: The northern ute. *Journal of Mathematics and Culture*, 1(1), 79–89.
9. Rosa, M & Orey, D. (2010). Etnomodeling as a pedagogical tool for the ethnomathematics program. *Revista Latinoamericana de Etnomatemática*, 3(2), 14–23.
10. Shirley, P., & Palhares, P. (2013). The role of ethnomathematics in mathematics education. *Revista Latinoamericana de Etnomatemática*, 6(3), 4–6.
11. Brandt, A., & Chernoff, E.J. (2017). The importance of ethnomathematics in the math class. *Ohio Journal of School Mathematics*, 7(1), 31–36.
12. Muzdalipah, I., & Yulianto, E. (2018). Ethnomathematics study: The technique of counting fish seeds (osphronemus gouramy) of sundanese style. *Journal of Medives*, 2(1), 25–40.
13. Sugiyono. (2014). *Metode penelitian pendidikan: Pendekatan kuantitatif, kualitatif dan R&D*. Bandung: Alfabeta.
14. Magnusson, S. Krajcik, J. & Borko, H. (1999). *Nature, sources, and development of pedagogical content knowledge for science teaching. Examining pedagogical content knowledge, the construct and its implications for science education*. Science & Education Library: Volume: 6.USA: Association for the Education of Teachers in Science.
15. Romberg, T.A., & Fennema, E. (ed). (2009). *Mathematics classrooms that promote understanding*. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.
16. Mergler, A. G., & Spooner-Lane, R. (2012). What pre-service teachers need to know to be effective at values-based education. *Australian Journal of Teacher Education*, 37(8). 66–81.

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