Anggria Septiani Mulbasari

Developing the PMRI Learning Environment on Geometry for Prospective Elementary School Teachers

Faculty of Teacher Training and Education
Universitas Sriwijaya

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DEVELOPING THE PMRI LEARNING ENVIRONMENT ON GEOMETRY FOR PROSPECTIVE ELEMENTARY SCHOOL TEACHERS

PENGEMBANGAN LINGKUNGAN BELAJAR PMRI MATERI GEOMETRI UNTUK DIGUNAKAN MAHASISWA CALON GURU SEKOLAH DASAR

(dengan ringkasan dalam Bahasa Indonesia)

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oleh
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APPROVAL PAGE

Developing the PMRI Learning Environment on Geometry for Prospective Elementary School Teachers

DISSERTATION

As the Requirement to Obtain a Degree
Doctor of Education (Dr.)
On
Doctoral Program of Mathematics Education
Faculty of Teacher Training and Education
Universitas Sriwijaya

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This dissertation has been examined on August 28th, 2025 and has been refined based on the revisions and suggestions from examination committee.

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Menyatakan dengan sesungguhnya bahwa Disertasi yang berjudul ***"Developing the PMRI Learning Environment on Geometry for Prospective Elementary School Teachers"*** ini beserta seluruh isinya adalah benar-benar karya saya sendiri, dan saya tidak melakukan penjiplakan atau pengutipan dengan cara yang tidak sesuai dengan etika keilmuan yang berlaku sesuai dengan Peraturan Menteri Pendidikan Nasional Republik Indonesia nomor 17 Tahun 2010 tentang pencegahan dan penanggulangan Plagiat di Perguruan Tinggi. Apabila di kemudian hari, ada pelanggaran yang ditemukan dalam disertasi ini dan/atau ada pengaduan dari pihak lain terhadap keaslian karya ini, saya bersedia menanggung sanksi yang dijatuhkan kepada saya.

Demikian pernyataan ini dibuat dengan sesungguhnya tanpa paksaan dari pihak manapun.

Palembang, 03 Sept 2025

Yang Membuat Pernyataan

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Preface

The purpose of writing this dissertation is to produce a PMRI learning environment for geometry material for use by prospective elementary school teacher students. The focus of the discussion is how the PMRI learning environment for geometry material is valid, practical and has potential effects.

The preparation and completion of this dissertation took a long time, and many parties were involved directly or indirectly in its completion. Therefore, I would like to express my deepest gratitude to

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Hopefully this dissertation can provide a positive contribution to the development of mathematics education and prospective elementary school teachers related to learning geometry material. The author also thanks all parties who have helped and supported the process of writing this dissertation.

Author

Anggria Septiani Mulbasari

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CHAPTER 1

INTRODUCTION

INTRODUCTION

1. Background Study

1.1 Importance skills 21st century especially ability think critical and mastery draft material geometry for teachers and students.

Effectiveness a educator in manage learning close the relation with succeed whether or not the education process in the country. Through management good learning, quality education will changed to positive direction (Dunluosky. J. dkk, 2013; Darling-Hammond *et al.* 2020). Quality education can give outlook about quality somebody as results education. Moreover education is the right place For to form character And pattern think somebody in solve problem (Liljedahl *et al.* 2016; Gravemeijer *et al.* 2017; Abramovich *et al.* 2019). With education somebody expected can face and resolve challenge or problems faced in his life, which is today known with the name of the Industrial Revolution Era 4.0 (Detikinet, 2018).

The RI 4.0 Era, complex competencies and abilities must owned somebody for can compete with others that can We hook up with skills 21st century . According to Wagner there is seven type skills life skills needed in the 21st century, namely (1) the ability think critical and solving problems, (2)collaboration and leadership, (3) agility and ability adaptability, (4) initiative and entrepreneurial spirit, (5) ability communicate effective Good orally or written, (6) able access and analyze information, and (7) have a sense of curiosity know and imagine (Wagner, 2010).

Another view is expressed by (Frydenberg. M., 2011), that in the 21st century everyone must own skills think critical , knowledge and skills digital literacy, literacy information, media literacy and mastery technology information and communication . More complex Again skills required For face 21st century as stated by the US-based Apollo Education Group, which identified ten required skills For working in the 21st century, namely skills think critical, communication, leadership, collaboration , ability adaptability, productivity and accountability, innovation, global citizenship, entrepreneurial skills and spirit, and ability For access, analyz, and synthesize information (Barry. M, 2012).

From the four views as as stated above , all four of them mentioned skills or ability think critical become need for everyone who lives in the 21st century and of course in the era of the industrial revolution 4.0. And that means in the world of education, skills think critical already is need for participant educate, so that educator must can develop ability think critical of students educate.Ability think critical mathematical can give Lots benefit to students, including understanding and development more concept well , and they can develop skills think For finish more questions complex with easy.Ability think critical refers to the ability somebody For use mental activity for solve problem For interesting logical and valid conclusions. (Ucisaputri *et al.*2020). In addition, thinking critical must also be owned by students prospective teacher.

Think critical is one of skills essential things to have owned learners in the 21st century (Prayogi *et al.* 2017). Intervention teaching think critical should implanted to student prospective teacher, thing This intended so that when a moment be their teacher can train him to students, In addition, encourage development thinking critical student considered as results important education tall (Tiruneh *et al.* 2017), and institutions education must strive and facilitate development ability think critical to

student prospective teachers (Innabi, H., & Sheikh, 2007). In addition, this skill is important not only for the professional development of pre-service teachers, but also for enabling them to foster reflective and analytical thinking in their students (Ahmad et al., 2023). At the higher education level, critical thinking is considered a core learning outcome and part of institutional responsibility (Apriliani et al., 2023) This aligns with national education policies, as stated in Ministerial Regulation No. 73 of 2013 and Ministerial Regulation of Research, Technology, and Higher Education No. 44 of 2015, both of which emphasize the importance of developing higher-order thinking skills (Kinoshita, 2022).

From the explanation on that Skills 21st century especially in terms of ability think critical is very influential discussion in various field specifically in education, very important content and must taught in reach skills 21st century is education mathematics (Gravemeijer *et al.* 2017). Mathematics Already taught from start education base until education high . According to Baykul in (Unlu *et al.* 2017) mathematics is very important tool studied by students, mathematics used For solve problem in science and life everyday, on the other hand , mathematics will help student think in a way critical and also can understand the world. From the explanation on seen that since Now become student prospective teachers, especially PGSD students , students Already trained For develop ability think critical especially on the material geometry.

Geometry is one of material in curriculum in every level education, things This can seen from objective learning mathematics (Mursalin, 2016). *National Council of Teaching of Mathematics* (NCTM) states that objective learning material geometry expected capable make Students : (1) describe, classify , and understand connection between type building two and three dimensional with use definition and its properties; (2) understanding

connection circumference , length sides , angles , area , and volume of the same building; and (3) making and criticizing arguments

According to (Fitriasari, 2020), geometry is one of eye studying mandatory must followed by students school teacher education base on year Firstly, geometry material is also found in the elementary school curriculum. According to Bobango (Wardhani. I. S, 2015) state that student dam understand draft geometry that is get up room need improved . In fact , among various branch mathematics a, the purpose of learning geometry is for students gain confidence self about ability mathematics , becomes breaker good problem, can communicate in a way mathematics , and can reason in a way mathematics .

From the explanation above, mathematics education particularly geometry is a highly relevant field for developing critical thinking skills. Geometry is included in the curriculum at every level of education, as reflected in the objectives of mathematics learning (Mursalin, 2016).

1.2 The problem mastery draft geometry for teachers and students

But in reality there are problems in PGSD students and students in geometry material. The results of the researcher's analysis through a questionnaire showed that 60.9% of geometry material was considered difficult for students (Mulbasari *et al.* 2023); Common problems that often occur found in students prospective school teacher base, which takes The course "geometry and its learning" is weakness draft geometry they. Learning mathematics that only relying on cooperative setting learning models Not yet capable bridge understanding draft they.Learning geometry that emphasizes existence tool props in class, actually Already Enough help student prospective teacher in understand draft Mathematics . However, the use of tool props the manipulative in question, especially in relation to with draft get up room Still Not yet accommodated (Aras *et al.*

2019) and also the reality results Study PGSD students in the subject studying geometry No Enough satisfying . This is can seen from achievement mark exam both UTS (Mid Semester Exam) and UAS (Final Semester Exam) for PGSD students . From the scores the end which is results.processing mark based on mark exams and assignments it turns out There is a number of students whose scores are below 55 so that they stated failed and must repeat eye studying This . Symptoms low results Study student This is one of indicator existence difficulty learning . (Dirgantoro, 2019), there is a number of the possibilities that can cause the occurrence obstacle in learning geometry in college students, namely : 1) knowledge prerequisites, 2) understanding concepts, 3) procedures, 4) principles, and 5) problem solving school problem base around 40-50%, because the teaching method is still conventional (Fuadiah, N. F., & Suryadi, 2016). From the explanation on material geometry become problems in students prospective elementary school teachers, besides elementary school students also experience it the problem is also in the material geometry .

In studying geometry, students need a mature concept so that student capable apply skills geometry owned like visualize, recognize many kinds of get up flat and space, describing drawing, sketching picture wake up, label point certain, and capabilities For know differences and similarities between get up geometry (Muhassanah *et al.* 2014). On the other hand , the portion material very large geometry compared to with other materials . In the competency base mathematics in school the basis compiled by the Ministry of Education and Culture in Minister of Education and Culture Regulation number 37 of 2018 that presentation material geometry in school base around 40-50%. This is what proves that that geometry No only part important in mathematics, but also in life daily (Cherif *et al.* 2017; Panaoura, 2014; Rofii *et al.* 2018) the reason is Because

geometry considered field that can push visualization , intuition , thinking critical , solving problem , reasoning deductive , argument and evidence logical student (Jupri. A., 2017; Seah. R., 2015). However in his learning sometimes students are also very difficult For understand material geometry (Fauziah *et al.* 2019; MdYunus *et al.* 2019) matter This due to Because the difficulty student in to form construction real accurate , requires accuracy in measurement , requires long time and even Lots students who experience obstacle in proof to the answer (Noto *et al.* 2019).

The reality that mathematics viewed as eye hard lesson understood by students, things this is also supported with the amount students who do not like learning This (Ricks, 2009), The problem of dislike students in learning specifically mathematics it seems will impact on low spirit and motivation learn, no can control material lessons , even avoid eye lesson , ignore task from the teacher so that happen decline mark learning and achievement Study students **(**Mufarizuddin, 2018). Meanwhile that, Cooney (Yusmin. E., 2016) say that difficulty Study mathematics classified to in three type among them is (1) difficulty student in use concept , (2) difficulty student in use principle, (3) difficulty student in finish verbal problems . Difficulty the due to Because learning mathematics during This delivered to student in a way informative, meaning student only to obtain information from the teacher only so that degrees his attachment can also it is said low and supported from test data analysis, 80% skills think critical student still below average.(Mulbasari *et al.* 2023).

In addition, studies also show that students' critical thinking skills, particularly in mathematics, remain low especially when dealing with geometric concepts (Iqbal & Akbar, 2021). This low level of skill is attributed to non-contextual teaching methods, limited use of manipulative media, and passive learning engagement (Ali, G. & Awan,

2021). In other words, this issue is closely related to the pedagogical skills of teachers.

1.3 Importance the role of teachers in to design learning mastery draft geometry

The role of teachers in teach mathematics is very important , teachers must can teach meaningful learning , because matter This will influence on context the meaning obtained student (Turmudi, 2008). According to (Hill *et al.* 2008) teachers need to involving student in every eye lessons , because matter That is aspect most important in competence professional teacher. This is the role that must be run by the teacher in build learning mathematics so as not to happen mistakes made by students . One of them competence or the ability to hold role important and become condition main in organization quality learning and must owned by a professional teacher is pedagogical abilities (Hakim. A., 2015; Bhakti *et al.* 2016; Asari *et al.* 2018; Misdar. M., 2015) also mention that competence or the most vulnerable teacher abilities lies in competence pedagogic . This is because of ability pedagogic is teacher's ability in manage learning . Ability pedagogic covering covers ability understanding and development participant education, planning and implementation learning , as well as evaluation learning (Dirgantoro, 2018). Next The low quality education is indication the need the existence of professional teachers (Kristiawan, M., & Rahmat, 2018). This becomes A Challenges faced by teachers and students prospective math teacher . Professionalism can become means For support achievement learning to higher level proceed (Engel *et al.* 2018). Based on study (Chetty et al., 2014) teachers have role important in help achievement success students . Teachers need to analyze and consider all component the necessary knowledge and skills (Gasteiger, H., & Benz, 2018). Professionalism This can influence practice

increase trust in teach (Brunsek *et al.* 2020; (Oppermann *et al.* 2016). Increasingly Lots proof show that educator influence quality class and results child (Burchinal *et al.* 2009).

However, on the other hand, the pedagogical skills of pre-service teachers are still not optimal. Many students struggle to design meaningful learning experiences, understand student characteristics, and select appropriate teaching approaches (Mulbasari et al., 2023; Prasetya, W., & Ardini, 2023) Contributing factors to these weak pedagogical skills include the lack of real teaching practice experience (Rahmawati et al., 2021),the dominance of theoretical instruction in teacher education programs (Loughran, 2010), and the limited training that bridges the gap between educational theory and classroom practice (Zeichner, 2009).

1.4 Environment Learning PMRI is a solution that can used by teachers in to design learning draft geometry

Professionalism a teacher can created through environment learning and teaching that enables student For Study mathematics with understanding (Carpenter, T. P., & Lehrer, 1999); (Crowe, 2010); (Hoogland, 2016). The importance of create and implement environment safe and supportive learning is essential for beginner teachers (Fox, 2009). When creating environment learn, need under consideration all influencing factors development participant educate (Thomson, N. E., & Wheeler, 2008). This due to the environment Study can support teaching (Osborne, 2013). Community education mathematics show that one of method provide environment supportive learning understanding from a number of representation of mathematical ideas (Gulkilik *et al.* 2020). Environment suitable learning For prospective teachers are environment learn RME, In understanding draft the mathematics using Realistic Mathematics Education (RME). Learning with RME approach makes

student capable to abstract situation concrete that exists in the real world to in draft mathematics (Farouq, 2017). The RME approach is expected can increase quality learning for student prospective teachers. RME provides opportunities for students prospective teachers for more understanding the transition process students inside learning (Gravemeijer, K., & Stephan, 2002); (Mudaly, V., & Sukhdeo, 2017), in line with research that has been done This learning environment is also developed to provide freedom for prospective teacher students to design and design the context in PMRI learning by choosing topics that are in accordance with the abilities possessed by students. This is also generally in accordance with the concept of "Independent Learning" which has just been launched by the Minister of Education and Culture, where Independent Learning is the freedom to learn that gives students the opportunity to learn freely and freely to learn according to their talents and abilities (Abidah *et al.* 2020).

Learning process is interaction between student with environment . Through interaction student this , as results from the learning process processing process occurs information become knowledge , skills and attitudes . Learning process always in progress in a environment , which is called environment education or environment study . According to (Andersone, 2017), " environment Study is a set condition organized physical , social , and informative with the purpose to which students form and implement his experience , knowledge , skills and attitudes to self themselves and the world around them . The results of the study Gribusts (Andersone, 2017) show that environment organized learning based on need moment This can increase performance Study students ." Environment conducive learning will make atmosphere Study become effective , meaning capable optimize potential possessed by teachers and students " (Zaiturrahmi, 2019). Environment learning and the learning process should designed No only allow student Study with One same

pattern /style But more to put students in appropriate situations with style each one learns individually (Ozerem, A., & Akkoyunlu, 2015). (Bates, 2019) to put forward that " no There is One environment optimal learning.There is possibility environment learning that is not limited , that's what makes teaching so interesting ". and based on the needs analysis doed by the researcher, the RME approach has not been implemented well in the learning environment of PGSD students. (Mulbasari *et al.* 2023).

The urgency of this research lies in the gap between the need for teachers with strong critical thinking and pedagogical skills and the lack of a learning environment that comprehensively integrates theory, practice, and pedagogical reflection in a contextual manner. Although Realistic Mathematics Education (PMRI) has been widely implemented in elementary mathematics instruction, previous studies have not specifically developed a PMRI-based learning environment for pre-service teachers, particularly in the context of geometry, designed to enhance both critical thinking and pedagogical abilities.

In this context, the learning environment is not limited to a physical space, but encompasses the interactions between students, lecturers, media, learning activities, and the overall atmosphere designed to support engagement and reflection (Fraser, 2012). The contextual approach (RME/PMRI) is grounded in the belief that active involvement in a meaningful learning environment can enhance students' critical thinking and pedagogical abilities. This is in line with several previous studies related to the development of learning environments. Fauziah et al (2020), found that a PMRI learning environment implemented through the Lesson Study K-S-K model is valid, meets practical criteria, and has the potential to improve the pedagogical abilities of prospective elementary school teachers. Putri (2011) developed a learning environment model

aimed at producing professional PMRI teachers, which consists of three components: campus-based learning, classroom practice, and PMRI teacher working groups (KKG), known collectively as the 3K model. At the PMRI Center of Universitas Sriwijaya (Unsri), training was provided to 28 core PMRI mathematics teachers. In PMRI pilot classes at SDN 117, SDN 179, SDN 98, and MIN II, classroom trials were conducted where participants practiced PMRI-based teaching. Additionally, PMRI KKG activities were held across four different groups, where student-teachers shared experiences and knowledge gained from validated training programs, fostering their social skills and professional development. Moreover, research by Zulkardi (2003) showed that the Learning Environment (LE) program is potentially effective in helping teachers understand Realistic Mathematics Education (RME) and improving their teaching performance using the realistic approach. Similarly, Efriani et al (2023) found that the Context-Based Active Student (CAS) learning model positively influenced teachers' instructional approaches by providing STEM-based structured steps to prepare pre-service teachers for mathematics teaching.

Based on the findings above, both the K-S-K and C-A-S models demonstrate potential for enhancing the critical thinking skills of pre-service teachers. Therefore, we integrated both models. Consequently, the researcher is interested in developing a PMRI-based learning environment for teaching geometry, specifically designed for prospective elementary school teachers, to be examined in depth. This study aims to evaluate the effectiveness of a Realistic Mathematics Education (RME) learning environment in geometry that is valid and practical for developing.

Thus, based on these factors, the process of developing the PMRI learning environment for prospective elementary school teacher students is expected to enable students to understand PMRI, design their learning

tools, implement the learning, and evaluate PMRI learning, which will be beneficial for these students when they become teachers. The researcher hopes that this development will help improve the quality of pedagogical skills and critical thinking abilities of prospective teachers and elementary school students in the future.

2. Structure Dissertation

A conducive learning environment will make the learning atmosphere effective, meaning it can optimize the potential possessed by teachers and students" (Zaturrahmi, 2019). An approach called PMRI (Pendidikan Matematika Realistik Indonesia) is one of the innovations in mathematics education in Indonesia. PMRI is Realistic Mathematics Education (RME) developed in Indonesia since 2001 (Sembiring, et al., 2010). RME is a mathematics approach originating from the Netherlands, introduced by Fruedenthal, who stated that mathematics is a human activity and mathematics must be related to the real world (Zulkardi, 2003; Zulkardi & Putri, 2019). By developing the PMRI learning environment, it can facilitate prospective teachers in enhancing their pedagogical skills and critical thinking abilities.

The problem in this research is: How to develop a valid, practical, and potentially effective PMRI learning environment for geometry material to be used by prospective elementary school teachers? To answer the formulation of the problem, the following research questions are presented:

a. How are students' needs for PMRI-based learning environments on geometry material in critical thinking skills?
b. How is the application of PMRI to critical thinking skills based on literature reviews?

c. How is the impact of PMRI on pedagogical skills based on literature reviews?

d. How is the use of traditional contexts of South Sumatran snacks in flat and spatial geometry materials?

e. How is the validity of student worksheets in the PMRI learning environment?

f. How to produce a PMRI learning environment for geometry materials that are valid, practical and have potential effects that are used by prospective elementary school teachers?

Dissertation This consists of from seven chapter. Chapter one This give description general about study This . Chapters 2-7 contain articles that have been handed over to ,or published in various journal research in the field education mathematics . Chapter 8 presents discussion and conclusion of the research in a way overall . Table 1.1 summarizes structure dissertation and show connection between chapters , publications and research questions .

Table 1.1. Structure Dissertation

Chapter	Topics
1	Introduction
2	Analysis of the Needs of the PMRI Learning Environment for Geometry Material on the Critical Thinking Ability of PGSD Students
3	Systematic literature review : A Critical Review with Reviews from the Head of the Indonesian Realistic Mathematics Institute (PMRI)
4	Impact of PMRI on Teachers' Pedagogical Competence
5	Exploration material geometry flat and space in South Sumatran Special Snacks

Chapter 2 chapter this explain , Situation conducive learning related with quality packaged learning in a environment study . Research objectives This is For describe analysis need environment PMRI learning about material geometry on skills think critical . Ability think critical is skills that must be owned by teachers, prospective teachers, and students in the 21st century, so That availability environment Study based on PMRI approach is very important for teachers, prospective teachers, and students, in particular prospective teachers. Research This use method study descriptive quantitative , with amount respondents who are special test question test ability think critical as many as 40 people who are Elementary School Teacher Education students at PGRI University Palembang and the number respondents who are special fill in questionnaire as many as 199 people, consisting of from students of PGRI University of Palembang, PGRI University of Silampari and PGRI University of Yogyakarta . Data collection was carried out with use tests and questionnaires . The data collected analyzed in a way descriptive and quantitative . Based on test data analysis , 80% skills think critical still below average, and analysis questionnaire show that 60.9% of the material geometry considered difficult for students; students also have not understand knowledge skills 21st century in particular skills think critical, and the PMRI approach is still Not yet applied with Good in environment Study students. Therefore that, is needed study more further

implementing PMRI's approach in environment learning and difficulties geometry can overcome .

Chapter 3 chapter this explain , related literature review study ability think critical with use approach PMRI. Methods used is a systematic literature review (SLR). The data being reviewed is articles related Ability Think Critical With Use PMRI's approach to the period 2010-2021 period . From a number of articles searched from syntax 1 - 4 found 8 matching articles with ability think critical with use PMRI approach . Based on analyzed results can taken conclusion that with use The PMRI approach can increase ability think critical , Students are very enthusiastic in learning with use PMRI Approach . Creative and innovative teachers use PMRI approach can make learning mathematics become fun , more interesting , no boring and liked by students . In addition implementation learning with PMRI approach , as well as atmosphere class can increase ability think critical , and also has an impact straight to the upgrade ability think critical students and characteristics student more good .

Chapter 4 chapter This explain about review in a way systematic literature related the influence of PMRI on improvement ability teacher pedagogy . This study use Systematic Literature Review (SLR) approach . Articles were obtained from the Google Scholar academic database with the keywords "PMRI and pedagogical competence of teachers". The results of the findings there are 13 articles that show this that PMRI contributes positive) against improvement skills teacher pedagogy , especially in aspect design learning based on context , management discussion class , differentiation strategy , and evaluation authentic , in research This only limited to the impact of PMRI on ability pedagogical . The results show Investment in strengthening teacher pedagogy through PMRI will give impact positive to improvement quality learning mathematics in Indonesia. Recommendations For training sustainable for

teachers, improvement collaboration between teachers and academics , as well as support policy more education strong in provide source PMRI - based teaching materials and resources

Chapter 5 This explain learning mathematics can associated with wisdom local / cultural local . Research objectives This is For explore with describe elements geometry found in snacks typical of South Sumatra which involves student prospective teachers of PGRI Palembang Elementary School. Data and information will taken through observation or observation and study library . Research This is study qualitative with approach descriptive . In research this , subject requested research the information is student prospective elementary school teachers. Results of exploration and analysis of research data This show that there is draft geometry in snacks traditional in South Sumatra. The results obtained from exploration find draft geometry found in snacks the among others: 1) wake up flat (square , rectangular) length , triangle , circle ,. 2) shape space (ball, cube , block , pyramid , and cylinder). Exploration results This can used For source Study new in learning mathematics . It started with show picture also formerly to students , then show form original snacks said , the steps final is make snacks shaped geometry.

Chapter 6 chapter This explain , develop PMRI -based teaching materials on the material geometry school a basis that meets valid criteria . The research method used in study This is study type studies development , with research doed covering three stage that is stage introduction , stage making prototype , and stage evaluation . Data collection techniques using walk-throughs were carried out with give teaching materials to next expert give comment as well as review at a glance on each content , design , and language . Data analysis techniques include walk-through results with expert analyzed in a way descriptive as input used For revise teaching materials , validation results validation expert review, and one-to-one

results . Development results PMRI -based teaching materials on the material geometry school valid basis is obtained from validation audit results expert from aspect content , construction , and language and one-to-one audits.

Chapter 7 chapter this to explain develop a valid, practical, and effective Pendidikan Matematika Realistik Indonesia (PMRI) learning environment to enhance the critical thinking and pedagogical abilities of pre-service elementary teachers. To achieve this aim, the study developed the Campus-Online-School (COS) model using a developmental research approach consisting of three phases: preliminary study, prototype development, and evaluation. Data were collected through observation, interviews, questionnaires, documentation, and tests, and analyzed using both qualitative and quantitative methods. The findings show that the developed learning environment is valid, practical, and effective in improving students' critical thinking and pedagogical skills. Critical thinking was assessed through critical thinking test, while pedagogical ability was evaluated using Guskey's framework. These findings offer important implications for teacher education, emphasizing the need to integrate comprehensive and contextual learning experiences to prepare future teachers who are reflective, adaptive, and equipped to face the challenges of modern classroom practice.

Chapter 8 chapter This explain , give description short about results obtained from all chapter previous . Last , chapter This discuss Finally, this chapter discusses the implications and impacts of the research.

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