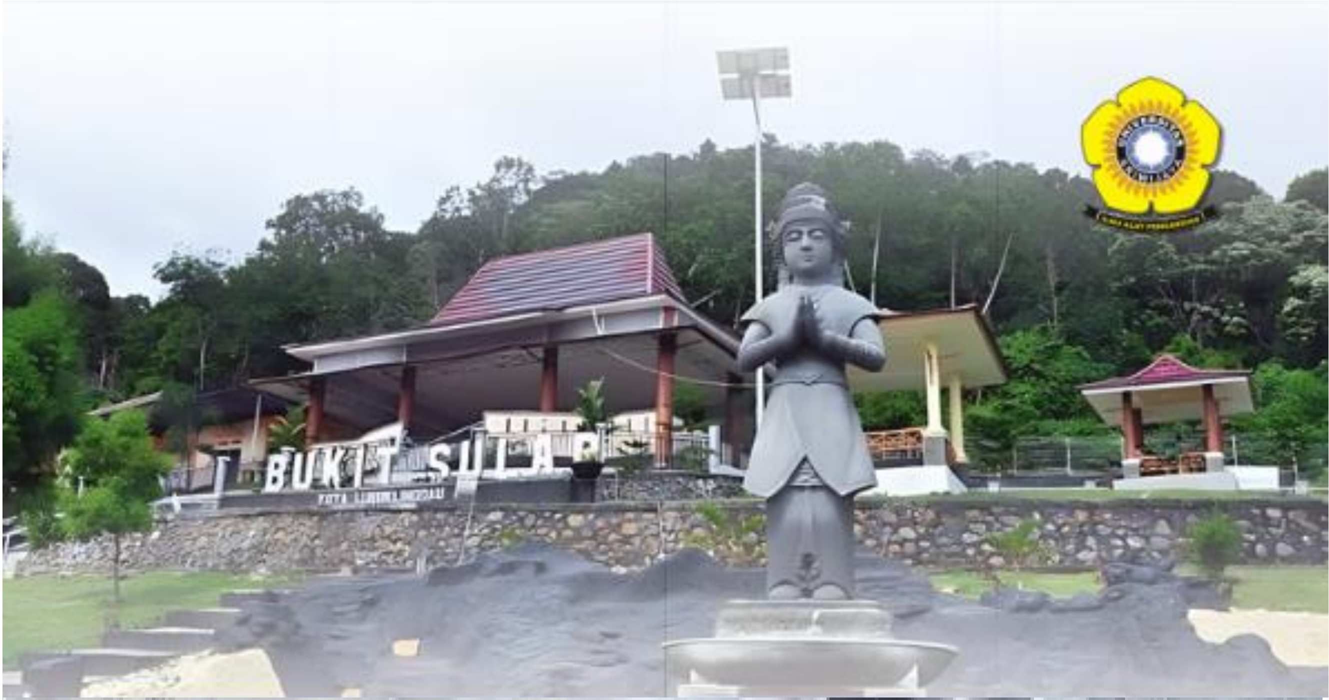

Idul Adha

LOCAL INSTRUCTIONAL THEORY DESIGN GEOMETRY LEARNING USING THE BUKIT SULAP LUBUKLINGGAU TOURISM CONTEXT FOR ELEMENTARY SCHOOL STUDENTS

Faculty of Teacher Training and Education
Sriwijaya University

Local Intructional Theory Design Geometry Learning Using The Bukit Sulap Lubuklinggau Tourism Context For Elementary School Students

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Adha, Idul

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LOCAL INTRUCTIONAL THEORY DESIGN GEOMETRY LEARNING USING THE BUKIT SULAP LUBUKLINGGAU TOURISM CONTEXT FOR ELEMENTARY SCHOOL STUDENTS

DESAIN *LOCAL INTRUCTIONAL THEORY* PEMBELAJARAN GEOMETRI DENGAN KONTEKS WISATA BUKIT SULAP LUBUKLINGGAU BAGI SISWA SD

Dissertation

To obtain a Doctoral degree at Sriwijaya University on the authority of the Chancellor, Prof. Dr. Taufiq Marwa, S.E., M.Si., in accordance with the decision of the Doctoral Council, which will be defended in public on, 12 October 2024, at 09.00 WIB

By
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Born on May 8, 1987
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Menyatakan dengan sesungguhnya bahwa Disertasi yang berjudul "***Local Intructional Theory Design Geometry Learning Using The Bukit Sulap Lubuklinggau Tourism Context For Elementary School Students***" 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.

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Preface

Alhamdulillahirobbil'alaamiin, I give praise and gratitude to Allah SWT for His abundant blessings, blessings, and gifts so that I can complete my dissertation entitled 'Local Instructional Theory Design Geometry Learning Using the Bukit Sulap Lubuklinggau Tourism Context for Elementary School Students" precisely in time. This dissertation is the result of research and literature studies that I carried out while studying at Sriwijaya University and have undergone several improvements in terms of learning design. Apart from that, this dissertation is one of the requirements for obtaining a Doctor of Education (Dr) degree in the Mathematics Education Doctoral Study Program, Faculty of Teacher Training and Education, Sriwijaya University.

Finally, with humility, I realize that this dissertation is still far from perfect. I gladly accept all constructive suggestions and comments from practitioners, observers, and mathematics lovers. Hopefully this dissertation can provide benefits to those who need it.

In completing the writing of this dissertation, the struggle was extraordinary. I feel that there have been so many contributions from various parties that I am surrounded by everyone who always supports me in completing my studies. Therefore, I would like to dedicate this section to these extraordinary people.

First of all, I would like to express my deepest gratitude to my promoter, Prof. Zulkardi, someone who has given me a lot of knowledge, motivation, advice and always encouraged me to complete this research. He was my lecturer when I took the Masters Program in Mathematics Education, I got inspiration and motivation from him, both when taking the Masters Program and when taking the Doctoral Program. Under his guidance, I undertook research on the PMRI theme, which was a local tourism theme. Prof. Zulkardi is an inspirational person and I really admire him. One day, I hope I will become a Professor like him.

Second, I would also like to express my deepest gratitude to my Co-Promoter 1, Prof Ratu Ilma, a figure who patiently educates me, always opens up research opportunities for me and always guides me toward the best research. He was also my lecturer when I took the Masters Program, and he had high enthusiasm and seriousness in imparting his knowledge to me, not infrequently I was admonished by him to always give the best in the assignments he gave. Hopefully, I can imitate his motivation and sincerity so that I can use it in my future assignments. Thank you for the motivation and inspiration. May Allah SWT always give his mercy to him.

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I would like to express my deepest gratitude to my parents, Father M. Teguh A. Roni (deceased) and Mrs. Supinah, as well as Father Masrial and Mother Dewi, who always prayed for me and always believed in my success. Also, I thank my entire family, who always pray for and support my success. Without them, my life would not be as good as it is now.

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I would also like to thank the authorities at PGRI Silampari University, where I work as a lecturer, who have given me permission to pursue a doctorate degree. I would also like to thank the An Nida Integrated Islamic Elementary School, where I did my research, which has given permission to research, as well as the teachers who have collaborated in the research.

Warm Regards,

Idul Adha

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Chapter 1
Introduction

1. The Gap Between Goals and Student Achievement

The development of technology and information in the 21st Century creates big challenges for education managers. In chapter 21, education must ensure that students have learning and innovation skills, skills in using and exploiting technology and information media, and can work and survive using life skills. There are four competencies and skills needed to face life in chapter 21, namely critical thinking and problem-solving skills, communication skills, creativity and innovation skills, and collaboration skills (Kemendikbud, 2020). The 2013 revised 2018 curriculum must integrate 21st-century skills in planning and learning processes; this is intended to prepare students to become successful individuals in the era of Revolution 4.0 (Dewi and Purwanti, 2019). 21st-century skills-based learning needs to be applied to the younger generation as a systematic and sustainable step in character formation, and aspects of knowledge, feeling, loving, and acting need to be looked at (Martini, 2018). The learning process that refers to Abab 21 skills in elementary school book analysis contains the values of never giving up, thriftiness, cooperation, creativity, accuracy, and tolerance (Widodo et al., 2019).

The PISA study released by the Organization for Economic Co-operation and Development (OECD) in 2022 shows that Indonesian students' abilities in mathematical literacy are still in the low category (OECD, 2023). This condition is an input for improving the quality of education in Indonesia, especially in the research carried out which must refer to input from the PISA results. Furthermore, the National Research Master Plan (RIRN) for 2021-2022 explains the focus of research themes related to the Green Economy, Blue Economy, Digital Economy, Tourism, and Independence. The government, through the Ministry of Education and Culture, has created a long-term research policy by creating (RIRN), one of which is about tourism (Kemdikbud, 2021). Based on this explanation, tourism is an alternative context for mathematics learning. This is in line with research (Priyanto et al., 2018) which combines tourism activities with educational activities, where tourists receive direct learning from tourist objects. Furthermore (Lusiana et al., 2019) said that the tourism context, in this case, the Jamik Mosque in Bengkulu City, can be used to introduce and understand geometric concepts.

There are many other tourist contexts that can be used as context in learning geometry.

This is also related to learning problems in schools. One of them is the problem of learning geometry material. Some of the problems of geometry learning include the existence of misconceptions of concepts in learning geometry in students and the need to design learning by adding activities that focus more on understanding concepts (Bustang et al., 2013), research to investigate wrong answers and misconceptions of outstanding students on the concept of angles in geometry (Butuner, et al., 2016), research on the design of learning lines and angles using wall clocks circle (Ramadhani, et al., 2019), geometry learning design using the context of the limas house (Widyawati, W., et al., 2016), learning research using *mobile learning* in teaching geometry (Cromton, H., 2015), Indonesian tin museum Pangkalpinang as an alternative to geometry learning (Apriani., F., 2019), ethnomathematics of the holy kretek dance movement to understand the concept of angles in geometry (Sa'adah, N., et al., 2021). The results of the research study on geometry material are the main material for researchers to provide solutions to geometry learning from a different perspective, namely designing PMRI learning using a tourism context. PMRI itself is a mathematics learning oriented to human activities, and its activities must be related to the real world (Sembiring, 2010).

Geometry is one of the materials in the curriculum at every level of education, as can be seen from the purpose of teaching mathematics (Mursalin, 2016b). *The National Council of Teaching of Mathematics* (NCTM) states that the learning objectives of geometry material are expected to allow students to: (1) describe, classify, and understand the relationship between two- and three-dimensional building types using definitions and their properties; (2) understand the relationship of the circumference, side length, angle, area and volume of the same building; and (3) making and criticizing deductive and inductive arguments about geometric ideas and relationships (Allen et al., 2020). The purpose of teaching geometry is to improve students' basic abilities including verbal, drawing, visual, logical, and application (Misnasanti & Mahmudi, 2018). The reason why it is important to learn geometry is broad knowledge; developing *problem-solving* skills; important role in learning other mathematical concepts; used in daily life; and lessons that attract attention (Simamora et al., 2018). Geometry can be seen as a concept that connects to many mathematical domains (Ahmad, 2022). In addition, the concept of geometry is closely related to the context of daily life (Clements & Sarama, 2011; Panaoura, 2014; Rofii et al., 2018; Serin, 2018). In geometry teaching, students can imagine, construct, and understand the construction of shapes to relate them to related facts (Praveen & Leong, 2013). Geometry learning activities are excellent for improving students' ability to think critically (Hidayat & Rosnawati, 2020); problem-solving skills (Rejeki et al., 2021); creative thinking skills (Jagom et al., 2020); learning geometry can improve communication and collaboration skills (Hobri et al., 2018).

In reality, students find it difficult to learn geometry because it has abstract characteristics (Ismail, 2020). The difficulty of learning geometry can be seen from several mistakes made by students including errors in concepts, strategies, procedures, and calculations (Özerem, 2012). Students experience failures in comparing between distinguishing the shape of an object, such as orientation (direction), ratio (comparison), tilt, and its size (Aslan & Arnas, 2007). In addition, there is a discrepancy in process standards, including teaching methods, approaches, and learning. The difficulty of students building space materials is identifying concepts. In addition, it describes the results of the reflection of objects with y = x lines as a mirror (Surgandini et al., 2019), as well as choosing the right formula to solve problems correctly (Fridgo et al., 2016), the use of media and developing materials (Wahyuni & Berliani, 2019).

In Indonesia, the emphasis in teaching and learning mathematics is on algorithms using formulas, memorizing without understanding the theory, and proof of geometric concepts applied to textbooks (Fauzan, 2002; Abdullah & Zakaria, 2012). Learning by memorizing formulas and applying them will not support students' understanding of geometry concepts. The stages of students' thinking development need to be considered in geometry learning (Abdussakir, 2012).

Similar to Van Hiele's theory, mathematics learning in geometry must be in accordance with the level of development of geometric thinking skills in students (Sulistiowati & Jupri, 2018; Cesaria et al., 2021). The quality of students' knowledge is determined by the thought process used (Abdussakir, 2012). Before moving on to the next level, students must go through a level in a mature sequence (Haviger & Vojkůvková, 2015; Salifu et al., 2018). The development of each stage depends on the learning method and content (Craft, 2000; Noraini, 2006). Van Hiele stated that the stages of students' thinking in learning geometry are the introduction stage (visualization), the analysis stage, the sequencing stage (informal deduction), the deduction stage, and the precision/accuracy stage (rigor) stage (Vojkuvkova, 2012). Visualization is the first stage for students in identifying and recognizing geometric shapes (Halat, 2008a). This is supported by the fact that geometric problems require visualization in solving problems (Yurmalia & Hasanah, 2021). This leads students to recognize the role of mathematics in life and make assessments. Knowledge of knowing and using the basics of mathematics in daily life is called mathematical literacy (Novita et al., 2012).

PMRI learning itself is learning using a real-world context originating from the Netherlands and developed in Indonesia in 2001 (Sembiring et al., 2010). In the Netherlands, PMRI is known as the Term *Realistic Mathematic Education* (RME) introduced by Freudenthal, which states that mathematics must be taught using a real-world context because mathematics is a human activity (Freudenthal, 2002). The implementation of PMRI learning emphasizes that students are given the opportunity to rediscover mathematics using well-chooses tasks, both with the help of teachers and the learning process directly from real-world contests, this will make learning more meaningful for students (Gravemejer, 2004., Zulkardi and Ilma 2006).

Tourism as a learning context, as well as studies that make tourism a learning context, namely the *development of* a local tourism learning model in Rembang Regency, Central Java (Winaryanti, E. et al., 2015), the design of an educational tourism model in the tourist attraction of Tulip village ((Priyanto et al., 2018), Improvement of critical thinking skills of junior high school students using guided Inquiri-based learning tools with Baning Tourism Forest learning resources (Dahlia, et al., 2018), Development of Mathematics Problems Based on Local Wisdom and Riau Tourism Attraction at the Preliminary Research Stage (Zulfah and Insani, 2020). This shows that tourism is not only a place for recreation, but also a place for mathematics learning.

2. Mathematics and Literacy Learning

Mathematics is a universal science that has an important role in various disciplines and develops human thinking and underlies the development of modern technology (Mashuri, 2019). Therefore, mathematics is given to all levels of education, both elementary and secondary schools, with the aim of equipping students to have the ability to think logically, critically, analytically, systematically, and creatively and be able to solve problems in daily life. Therefore, mathematics learning must be taught properly, one of which is using the right techniques. (Krismanto, 2003) explained that there are two techniques in teaching mathematics, namely explaining techniques and asking techniques. The following are important things to do in carrying out the explaining technique, namely:

a. Use simple, clear, easy-to-understand, and communicative language
b. Words should be heard clearly, completely, specifically, and with the right information
c. The material is prepared systematically toward the goal
d. Appearance should be attractive, covered with movement and healthy humor
e. Hold variations or interludes with other methods, such as questions and answers, using aids such as props.

As for the questioning technique, it is necessary to pay attention to things, namely motivating students, refreshing student appreciation, starting discussions, encouraging students to think, directing students' attention, encouraging investigation, diagnosing/examining student responses, attracting students' attention, and inviting student questions. Furthermore, the objects in mathematics are abstract, and it is not uncommon for teachers and students to experience obstacles in understanding the meaning of the mathematics studied. To facilitate so that students can understand the abstraction of mathematics learning, mathematics needs to be taught with realistic or real things. In this case, realistic learning is known as Realistic Mathematics Education (PMR). (Holisin, 2007) explained that in PMR learning is carried out using the principles of progressive reinvention/mathematization, dictating phenomena, and developing their own models).

Mathematical literacy is the knowledge to know and use the basics of mathematics in daily life that are relevant to the phenomenon or problem they are facing and then continue with problem-solving using mathematical concepts (Ojose, 2011). Mathematical literacy is the knowledge and ability of students to take and use the mathematical knowledge and skills they have acquired from the classroom to real-life experiences as well as the ability to understand situations involving mathematics (Sumirattana et al., 2017).

Mathematical literacy has an important role in solving students' real-life problems in supporting literacy skills, teachers can use real contexts outlined in learning tasks in the classroom (Susanta et al., 2023). The real context needs to be explained in developing student literacy to bridge students in solving mathematical problems. This is in line with Mansur, who stated that mathematical literacy is disembarkation as a person's ability to formulate, use and interpret in various contexts (Mansur, 2018). Context can lead to meaningful learning when students actively demonstrate the usefulness of certain ideas and skills by asking questions, explaining, and justifying reasons (Widjaja, 2013). The effective use of real context in learning mathematics can be a supportive thing in improving mathematical literacy skills (Kolar & Hodnik, 2021; Susanta et al., 2023; Wijaya et al., 2021).

Literacy in the context of mathematics is to have the power to use mathematical thinking in solving daily problems to be better prepared to face life's challenges. Intended mathematical thinking includes a problem-solving mindset, logical reasoning, communicating, and explaining. This mindset is developed based on concepts, procedures, and mathematical facts that are relevant to the problem at hand (Stacey & Turner, 2015). In addition, mathematical literacy is closely related to modeling mathematics, namely the ability to formulate mathematical models, use knowledge and skills to work on models, and interpret and evaluate results (Stacey & Turner, 2015).

3. 21st century 4C Competency Skills

Facing the challenges of the 21st Century, everyone must have critical thinking skills, knowledge, and abilities of digital literacy, information literacy, media literacy, and mastery of information and communication technology (Mugot & Sumbalan, 2019; Trilling & Fadel, 2009). Students must be equipped with critical thinking and problem-solving skills, which will lead to the ability to think critically, laterally, and systemically, especially in the context of problem-solving (Nahdi, 2019). The ability to communicate and cooperate is to be able to communicate and collaborate effectively with various parties. The ability to create and renew is related to a person's ability to develop his creativity to produce various innovative breakthroughs. Mathematics learning, according to NCTM, requires problem-solving, reasoning and proving, communication, connection, and representation skills, so mathematics learning is closely related to 21st-century skills (NCTM, 2000). In line with this, the Ministry of Education and Culture formulated that the 21st-century learning paradigm emphasizes students' ability to find out from various sources, formulate problems, think analytically and collaboratively, and collaborate in solving problems (Daryanto, 2017).

For this reason, in the 21st century, schools are required to have creative *thinking*, critical thinking and *problem-solving*, communication*, and* collaboration, commonly known as the 4Cs (Redhana, 2019). 21st-century skills focus on critical learning skills and innovation (Trilling and Fadel, 2009). Thus, mathematics learning in the 21st-century era is required to emphasize these four skills so that students can use various techniques to develop their ideas and bring out their potential and skills.

4. Indonesia Realistic Mathematics Education (IRME)

PMRI was first introduced by Freudenthal, who stated that mathematics learning must be related to the real-world context (Freudenthal, 2002). This means that in learning mathematics, students must be taught mathematics in their daily lives. Abstract mathematical concepts are taught using real situations so that mathematics learning becomes meaningful for students. Real situations can be in the form of objects that are around students, human activities, and situations that occur in nature can also be context. By learning to use real situations, students will gain their own experience, and they can also find concepts and ideas in mathematics. Furthermore, Freudental (2002) explained that education must be directed to learning in real situations so that children can rediscover mathematical ideas and concepts. This means that in PMRI learning, real situations are characteristic of mathematics learning in students so that children can get direct experience.

PMRI is seen as a human activity, Gravemeijer (1994) explains three principles of PMRI, namely:

a. Guide Reinvention and Progressive Mathematization

The guided discovery learning process is a learning process where students are given the opportunity to discover mathematical concepts on their own. For this reason, it is necessary to design learning activities in such a way that students are able to find mathematical concepts by themselves. The design of learning activities begins with making temporary guesses about the activities that will be achieved by students, designed in such a way that the activity directs students to find their own concepts. Learning activities are carried out in groups; in the process, students discuss with their fellow group friends, making guesses from the activities carried out. From this process, the learning experience of students is awakened. Thus, learning activities emphasize the process more than the results to be targeted.

Meanwhile, the process of *progressive mathematization* occurs from a real context, which then becomes an idea in abstract mathematics. Mathematization activities begin with understanding problems or problems from the context and then students conduct experiments using symbols that arise from their own ideas, then solve the problems and problems. This activity emphasizes the process of mathematization from non-formal mathematics to formal mathematics. This process also trains students to be able to find strategies in solving a given problem or problem.

b. Didactical Phenomenology

The principle of Didactical Phenomenology emphasizes that learning mathematics must start from a meaningful context for students, then designed to bring about the learning process (Zulkardi, 2002). This principle gives students the flexibility to learn from real contexts and phenomena that are inherent in the real world. Thus, the learning that occurs has meaning, and students experience the experience of discovering mathematical concepts for themselves. The context used must provide opportunities for students to build their knowledge.

c. Self-develop Models

The principle of self-development is the principle of developing an independent model. This principle plays a very important role in understanding informal mathematical concepts and formal mathematical concepts. The problems presented in informal mathematics are a trigger for students to learn to express ideas, and then these ideas will form knowledge, which will later become the discovery of students' mathematical concepts. From informal problems translated in the form of symbols, students will build knowledge to understand formal mathematics. In other words, learning is carried out from context problems to find informal forms (model of) and then continue to find formal forms (model for), and in the end, students will get mathematical concepts in abstract form (standard).

Furthermore, in PMRI, there are five characteristics (Zulkardi & Putri, 2019), namely:

a. *Use of Contextual Problems*

Making the context used is the initial problem to trigger the learning process for students. This context builds students' initial knowledge of mathematics to understand mathematical concepts in the real world.

b. *Use of models*

using real-world problems or contests as the basis for mathematical modeling. These characteristics provide students with the opportunity to develop models, which will bridge students to understand the subject matter.

c. *Use of students' Contribution*

The learning process involves students' contributions to constructing their own knowledge, which ultimately leads students to understand informal mathematics and formal mathematics.

d. *Interactivity*

This process emphasizes student activities such as collaboration, communication, and discussions that will build an active learning process. This active learning will help one student and the other student to understand the ongoing learning.

e. Interviewing of learning strands

This characteristic explains that there is a connection between each process carried out in learning. Each other's activities are related to each other to achieve learning goals.

5. Tourism as a Context in Mathematics Learning

Educational tourism is a tourism concept with positive values, where this concept combines learning activities with tourism activities (Priyanto, 2018). This concept is edutainment, namely learning accompanied by fun activities. Learning using the concept of tourism can trigger students to learn more enthusiastically because elementary school peers like tourism activities. Judging from the characteristics of students in elementary schools, the context of local wisdom is an attraction for students (Zulfah, 2020). Furthermore, (Winaryanti et al., 2012) explained that the local tourism learning model consists of (1) *local tourism classes*, namely classrooms designed with various images and products of regional potential, and (2) local tourism information, namely web-based learning of regional potential information. The explanation above emphasizes that the potential of the region can be used as a laboratory or learning resource, with the hope that tourism is not only limited to tourism activities but also designed for the learning process in schools.

Tourism is a pillar of the development process because it is one of the dominant economic activities in the context of economic development (Wijayanti, 2017). The Lubuklinggau city government makes tourism a supporter of economic improvement with the slogan "let's agelong ke lubuklinggau," and one of the tourist destinations that has become an icon of the city of Lubuklinggau is Bukit Sulap (Lubuklinggau Dispar). The basic policy of the National Research Master Plan (RIRN) in 2022 makes Tourism a leading theme in research (Ministry of Education and Culture, 2021). This is a great opportunity for researchers and educators to make tourism the main part to be used as an object of research and context in learning. In line with the learning of Indonesian Realistic Mathematics Education (PMRI) emphasizes that students are given the opportunity to rediscover mathematics using *well-chosen tasks*, both with the help of teachers and the learning process directly from real-world contests, this will make learning more meaningful for students (Frudental, 2002).

Learning mathematics through context can facilitate students' abstract thinking. Through this learning, students can carry out the process of abstraction, idealization, and generalization about mathematical objects (Lusiana et al., 2019). It also allows students to perform physical and mental activities through a realistic approach. Mathematical concepts can be conveyed using tools or media that are realistically easy for students to understand. The characteristics of realistic learning are also called the term

PMRI. In order to be able to release this learning, research is needed with the aim of exploring mathematical concepts.

Based on the description above, the Bukit Sulap tour is the context for the exploration of mathematics learning using PMRI. PMRI learning itself is learning using a real-world context, originating in the Netherlands and developed in Indonesia since 2001 (Sembiring, 2010). In the Netherlands, PMRI is known as the Term *Realistic Mathematic Education* (RME), introduced by Freudenthal, which states that mathematics must be taught using a real-world context because mathematics is a human activity (Zulkardi & Ilma, 2006). The implementation of PMRI learning emphasizes that students are given the opportunity to rediscover mathematical concepts through real-world contexts.

6. Bukit Sulap as a Context for Mathematics Learning

Regional potential can be used as a laboratory and learning resource, so learning can be associated with regional potential (Winaryanti, E. et al., 2015). Bukit Sulap is the lungs of the city and a tourist icon of Lubuklinggau City. Bukit Sulap is a Bukit area that is the highest peak of the city of Lubuklinggau. The Bukit Sulap has an elevation of 700 meters above sea level. This tour is very crowded with tourists every day, both from Lubuklinggau and the surrounding area. Not surprisingly, the Bukit Sulap is the symbol of Lubuklinggau City. This Bukit is called the Bukit Sulap because of its different shapes when viewed from different angles, and it often appears and often disappears. The Bukit Sulap is invisible in the morning due to the fog covering it. This is the uniqueness of the Bukit, which was finally known by the surrounding community as Bukit Sulap (https://dispar.lubuklinggaukota.go.id/). The Bukit Sulap is a real context, which is the local wisdom of Lubuklinggau city tourism, and it is appropriate to use it as a context for learning Geometry Material. The image of the Bukit Sulap can be seen in the picture below.

Figure 1. Bukit Sulap Tourism

7. Desain Reseach

Design research is a research paradigm that aims to develop the sequence of activities and understand an empirical understanding of how learning occurs (Akker et al., 2006). Furthermore, Gravemejer and Van Erde define design research as a research method that aims to develop Local Instructional Theory (LIT) in collaboration with researchers and educators to improve the quality of learning (Gravemejer & Var Erde, 2004). Likewise, Plomp mentioned *design research* as a systematic learning starting from planning, developing, and evaluating all interventions related to education, such as programs, learning processes, learning environments, teaching materials, learning products, and learning systems (Plomp, T., 2013). Furthermore, Akker et al. and Plomp mentioned that *design research* is distinguished into two types, namely *development studies* and *validation studies*. In *development studies,* the purpose of *design research* is to develop learning products such as media and learning processes to overcome practical problems in the field, while *validation studies* aim to develop learning theories and their interventions in the learning process (Van Eerde, 2008).

Furthermore, Akker explained that there are five characteristics *of design research*, namely *interventionist nature, process-oriented, reflective component, cyclic character, and theory-oriented* (Akker et al., 2006). For validation studies type research, there are three phases that must be carried out, namely 1) *Preliminary* design phase, namely In the first phase, the process carried out is to conduct *a literature review*, formulate research objectives, and develop a *Hypothetical Learning Trajectory* (HLT) and designing instruments for the learning process, HLT is a hypothesis or prediction about how students' thinking and understanding develop in the learning process. So, in this first process, what is produced is a draft HLT, 2) Teaching Experience Phase, namely In this phase, the process is in the form of testing the learning sequence that has been made in the first phase. In this phase 2 processes are carried out, namely *pilot experiments* and *teaching experiments. The experimental pilot* tested the learning design in a small group, and the *teaching experiment* tested it in a large group. The purpose of this phase is to test the learning sequence that has been designed and develop how the design understanding in the learning sequence works, 3) In The *retrospective analysis* phase, namely teaching experience *activities*, the data has been obtained, then the next activity is to analyze the results of the learning activities that have been carried out. HLT serves as a guide in the *retrospective analysis*. The things analyzed were learning assumptions, assumptions about learning, observation of the process during learning, and analysis of the achievement of learning objectives. If the goal of learning has not been achieved, then the learning cycle will be carried out in the second phase. If the goal of the learning design has been achieved, then the HLT that has been designed will produce *Local Instructional theory* (LIT) (Wijaya, W., 2008).

For research on the type of development studies, Gravemejer (2004) stated that there are three phases that must be carried out, namely:

a. Fase Preliminary design

In the first phase, the process is carried out to conduct a literature review, formulate research objectives, develop a Hypothenical Learning Trajectory (HLT), and design instruments for the learning process. Wijaya (2008) explained that HLT is a hypothesis or prediction about how students' thinking and understanding develop in the learning process. So, in this first process, a draft of the Hypothenical Learning Trajectory (HLT) was produced.

b. Fase Teaching Exsperiment

In this phase, the process is in the form of testing the learning sequence that has been made in the first phase. In this phase, 2 processes are carried out, namely pilot experiments and teaching experiments. The experimental pilot tested the learning design in a small group and the teaching experiment tested it in a large group. The purpose of this phase is to test the learning sequence that has been designed and develop how the design understanding in the learning sequence works.

c. Fase retrospektif analysis

The data for the teaching experience activities was obtained, and the next activity was to analyze the results of the learning activities that were carried out. HLT serves as a guide in the retrospective analysis. The things analyzed were learning assumptions, assumptions about learning, observation of the process during learning, and analysis of the achievement of learning objectives. If the goal of learning has not been achieved, then the learning cycle will be carried out in the second phase. If the goal of the learning design has been achieved, then the HLT that has been designed will produce Local Instructional theory (LIT).

Local Instructional Theory (LIT) is a theory about the process by which students learn a mathematical topic and a theory about the media or devices used to help the learning process of the topic (Gravemeijer & Van Eerde, 2009). In LIT, educators design an HLT for mathematics topics by choosing activities according to the conjectures that arise in the learning process (Wijaya, 2012). LIT is expected to be related to a set of instructional activities for a specific topic or a theory that describes the alleged learning trajectory on a certain topic, a series of learning activities and methods used to support that learning (Bakker, 2004). Therefore, this LIT is a theory that explains the learning trajectory used in the learning process through its activities so that it can help students learn.

8. Structure in a Dissertation

In this dissertation, there are several problem formulations:

a. How Systematic Literature Review: Angle Learning Using a Realistic Mathematics Education Approach?
b. How The context of the inclinator on Bukit Sulap in learning angles for elementary school students?
c. How w learning Trajectory for Surface Area Concept with the Context of the Tourist Destination Bukit Sulap?
d. How a learning trajectory for the concept of polyhedron surfaces in the context of the Bukit Sulap tourist destination?

The design of mathematics learning for geometry material in the context of Bukit Sulap tourism is intended for elementary school students. The context used in this study is the context of the buildings found in the Bukit sulap Tour which is an introduction for students to understand geometric materials. There are six chapters in this dissertation, four of which are journal articles related to research. The entire chapter of this dissertation is presented in Table 1.

Table 1. Dissertation structure

Bab	Topik
1	Introduction
2	*Systematic Literature Review*: Pembelajaran Sudut Menggunakan Pendekatan Pendidikan Matematika Realistik
3	*The context of the inclinator on Bukit Sulap in learning angles for elementary school students*.
4	A Learning Trajectory for Surface Area Concept with the Context of the Tourist Destination Bukit Sulap
5	When deigner meets local culture: The promising learning trajectory on the surface area of polyhedron?
6	Discussion and Conclusion

In Chapter 2 of this chapter, the researcher conducted a literature review related to corner learning using Indonesian Realistic Mathematics Education (PMRI). The method used is *Systematic Literature Review* (SLR). The data in this study is angular learning information using (PMRI) taken from selected articles. The articles that were used as sources, as many as 32 articles, were then taken as the main reference in this study as many as six articles with the criteria, namely (1) the content taught was about angles, (2) using the PMRI approach, (3) using *the design research method*, (4) articles came from reputable journals and indexed by Sinta and Scopus. Based on the results of the study, it was found that (1) the initial problem in the study was students' misconception of the concept of angles, (2) the use of the PMRI context could bridge students in understanding of the context of the angle, (3) learning activities produced *local instructional theory* (LIT), (4) the results of the study stated that learning became more meaningful because students learned from real situations.

Chapter 3 This section explains the learning trajectory of solving corner learning problems in the context of Bukit Sulap Tourism. Angular learning design using the context of Inclinator on Bukit Sulap. Learning is designed to begin using real contexts, with the aim that students understand angles in daily life. Then, from this real context, students understand the concept of angles in an abstract way. The results of the study obtained an analysis of students' thinking in understanding the concept of angles, which is where the context of the Inclinator in Bukit Sulap can help students understand the concept of angles.

Chapter 4 of this chapter explains the learning trajectory of flat building surface area material in the context of Bukit Sulap Tourism. The design research method is based on the type of validation studies, which consists of three stages: preparation and design, experimental teaching, and retrospective analysis. The subjects of this study are 27 elementary school students in Lubuklinggau City, Indonesia. The instruments used in this study are surface area problem-solving task sheets, video recordings of in-depth learning interviews, field notes, and observation sheets. The results of the study show that the learning trajectory designed in the context of the Bukit Sulap Tourism can help students understand problems, develop problem-solving plans, implement plans, and interpret the results of problem-solving. The learning trajectory consists of five activities, namely defining the context of the problem, self-reviewing, designing a resolution plan, implementing the solution plan, and ending with the establishment of principles regarding surface area. Finally, the student's learning trajectory in solving surface area problems uses the practical context of Bukit Sulap tourism to teach the principles of flat building surface area. This learning is the right approach to improve problem-solving skills regarding surface area.

Chapter 5 of this study aims to design a learning trajectory for teaching the surface area of polyhedron using IRME in the context of Bukit Sulap tourism. Employing a research design with a validation study type, the study was conducted in three phases: preparation and design, experimental teaching, and retrospective analysis. The participants were 27 elementary school students from Lubuklinggau City, Indonesia. Data collection instruments included surface area problem-solving worksheets, video recordings of in-depth learning interviews, field notes, and observation sheets. The findings suggest that the Bukit Sulap tourism context significantly enhanced students' understanding of surface area problems, specifically those involving combinations of cuboids and cubes. Additionally, IRME effectively facilitated students' comprehension of abstract mathematical concepts, particularly the surface area formulas for cubes and cuboids. The study concludes that using the Bukit Sulap tourism park context as a starting point for teaching the surface area of polyhedron aligns well with the principles of IRME..

Chapter 6 This section provides a brief overview of the results obtained from the previous four chapters. This chapter explains local instructional theory, learning geometry, and the process of discovering the concept of geometry learning. This chapter presents the Iceberg as well as its elaboration, which is accompanied by a hypothetical learning trajectory. This chapter also briefly explains the local instructional theory generated during the study. At the end of the explanation of the process that has been produced, this chapter also explains the limitations of the research and recommendations for the next research.

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