CAPLAIRE: Learning Model Design Based on Scientific Literation

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Abstract. Literacy is a culture that must be cultivated as a skill capital in the educational environment so that students can keep pace with the rapid advances of the 21st century. Currently, the UNIMED Elementary School Teacher Training Department does not yet have a learning model integrated into basic science education. Therefore, this time we will conduct research to develop an integrated learning model for scientific literacy. The learning model to be developed is called "CAPLAIRE" Learning Model: Science Learning Model Innovation Based on Science Literacy for Elementary Teacher Education Students". Through this research, it is hoped that the UNIMED Elementary School Teacher Training Department will develop a learning model that provides elementary school teacher candidates with the opportunity to provide learning experiences while imparting academic skills to elementary school students. This research is Research and Development by using the ADDIE model. The ADDIE model consists of his five phases: analysis, design, development, implementation, and evaluation. Based on these steps, the CAPLAIRE learning model was designed. A scientific learning model based on scientific literacy. The resulting product was revised based on suggestions from the effectiveness testing process through small group testing and field testing. The final step is evaluation and testing to determine whether the product is effective. Developmental research ultimately led to the creation of the CAPLAIRE learning model, a scientific learning model based on a valid, practical, and effective scientific culture.

Keywords: Caplaire, Learning Model, Scientific Literation.

1 Introduction

Literacy is a culture that must be developed in the educational environment as skills capital for students to face the rapid progress of the times in the 21st century. Indonesia is one of the countries that must be more serious about pursuing this literacy culture in order to be able to compete internationally. The Result of Program for International Student Assessment (PISA) in 2018 exam scores attest to this. Indonesia continues to lag well behind ASEAN and OECD nations [8]. OECD nations (Economic Co-operation and Development) is the organization created the PISA exam, which is well known, to evaluate students' reading, arithmetic, and science skills after they have completed or are almost finished with their basic education. The results of the examination are compared across national boundaries.

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Table 1. Overview of Indonesia's PISA 2018 Capabilities and Comparison Countries

Country	Reading Literacy	Mathematic Literacy	Science Literacy
Filipina	339	352	357
Thailand	392	418	425
Indonesia	371	379	396
Peru	400	399	404
DKI (Indonesia)	410	416	424
DIY (Indonesia)	411	422	434
ASEAN (rerata)*	413	431	433
Brasil	413	383	404
OECD (average)*	486	490	488

(Source: Center for Educational Assessment Research and development Agency Ministry of Education and Culture, 2019) [2]

It is evident from that table that Indonesian students' PISA 2018 results were lower than the average OECD rating, ASEAN countries and a number of countries with characteristics similar to Indonesia, such as Peru and Brazil. These results are a strong reason for Indonesia to be more diligent in familiarizing students with a culture of literacy in the hope of boosting Indonesia's PISA test results in the following year [11].

We need to familiarize future elementary school teachers with this reading culture at the elementary school level by providing opportunities for integrated learning of reading and writing skills. When it comes to literacy, students must be equipped with six basic skills: Digital literacy, scientific literacy, numeracy, financial literacy, literacy, and cultural and civic literacy. This study focuses on scientific competencies integrated into science education in the primary school teacher training program of Negeri Medan University. Currently, there is no learning model that includes academic ability in the Department of Elementary Education, Faculty of Education, UNIMED. As part of its efforts to develop professional teacher candidates, UNIMED Primary Teacher Education offers students a variety of courses to understand and teach their skills [13]. Through this research, it is hoped that the Institute of Teacher Education will be able to establish an educational model that can provide educational experience to future elementary school teachers while at the same time providing technical literacy opportunities to elementary school students.

Scientific literacy is defined as contextual scientific knowledge and skills and a willingness to engage. and science-related issues [7]. Basically scientific literacy is not only used in science learning but science skills learning content is used only in science learning so scientific literacy should be used in science learning. The presence of a teacher is an important factor in the educational process of primary school. This means that the face and color of education is influenced by the skills and abilities of qualified prospective teachers especially in primary schools [1].

As explained in the previous paragraph on scientific competence, we can conclude that a person who is considered scientifically competent has the following skills: (1) being able to identify questions; (2) (3) Be able to explain understandable scientific phenomena. (4) Able to draw conclusions based on facts and evidence obtained at the scene. (5) We must recognize the fact that science and technology shape the natural, intellectual and cultural environment, (6) Must be willing and interested in science-related topics.

The following table shows that the science learning of the Faculty of Education and the Faculty of Elementary School Teacher Training (UNIMED) still has some deficiencies and does not promote the development of students' scientific abilities.

Table 2. Results of Observations of Science Learning in the Elementary School Teacher Education Department UNIMED

No	Science Literacy Ability	Implementation in Science Subject	
		Yes	No
1.	Able to identify questions	✔	
2.	Has the ability to acquire new knowledge	✔	
3.	Able to explain scientific phenomena		✔
4.	Able to draw conclusions based on facts and evidence obtained in the field		✔
5.	Have the awareness to understand that science and technology shape the natural, intellectual and cultural environmen		✔
6.	Have a willingness to be involved and care about science-related issues		✔

(Source: Research Data, 2022)

From the table of observations above, it can be seen that science learning in the Department of Elementary School Teacher Training (UNIMED) still does not support the overall development of students' scientific skills. Fazilla in his study found that the results of basic scientific knowledge in his two classes tested were that his 47,3% of students did not achieve basic scientific knowledge and his It showed that it was 38,8% [4]. Furthermore, Syofyan and Amir in their study found that consistent application of scientific literacy in learning is necessary to train 21st century skills and serve as a basis for nation-building in students' future [10]. I discovered that. Therefore, an integrated learning model of scientific literacy is needed, which is expected to develop the scientific literacy skills of aspiring elementary school teachers and then integrate them with scientific literacy to design learning in elementary schools.

The learning model developed must be adapted to the basic principles of scientific literacy. In the national education system, the concept and mindset of science education is written and uses a scientific and inquiry approach, problem-based and project-based learning, products produced by students are project-based . As they continue to refine their mentoring techniques, instructors and tutors will develop into reflective mentors [13]. Therefore, on this occasion the researcher will conduct development research on a learning model. The learning model that will be developed is called the CAPLAIRE learning model: Innovation in Science Learning Model Based on Scientific Literacy for Primary School Teacher Education Students. This model is an integration of problem and project based learning.

Through research into the development of this learning model, it is hoped that science learning in the PGSD FIP UNIMED Study Program will be able to grow and strengthen the scientific literacy abilities of PGSD students and will subsequently produce prospective elementary school teachers who are able to design science literacy-based learning for elementary school students.

2 Research Method

The Faculty of Education Teachers of Elementary Schools at UNIMED conducted this study. The research period lasted 11 months, from to November 2023. The "CAPLAIRE" learning model will be built through this kind of research and development, to a model of scientific learning based on the scientific culture of primary school teacher training students. Model The development used is the development model consisting of five stages including analysis, design, implementation and evaluation. The population studied is composed of 380 students in the primary school teacher training semester. One hundred students made up the research sample. Purposive sampling was the sample strategy employed to determine who ought to be a part of the study.

The following are the methods used in this study to acquire data: (1) Two types of validation were performed: construct validation and content validation. Validation sheets were used to gather data; (2) observation sheets were used to watch how the "CAPLAIRE" Learning Model was being implemented; (3) questionnaires were used to gather data on lecturer and student responses to the "CAPLAIRE" Learning Model; and (4) interviews were used as supporting data to gauge how useful and effective the "CAPLAIRE" Learning Model was. An interview guide served as the tool.

This study included both quantitative and qualitative descriptive data analysis as its method of data analysis [9]. Data from questionnaires for expert and small group tests were percentage-analyzed and qualitatively described. Qualitative flow model data analysis is used to evaluate field test/user test data as a learning process in a development environment using multi-functional principles. Data reduction, data display, and conclusion- or verification-drawing are examples of analysis activities. Depending on the type of data, data reduction tasks include coding and classification. data presentation using headings, tables, charts, pictures, and other visual aids. The information provided has been checked, evaluated, and drawn conclusions from.

3 Result and Discussion

The study was conducted on 40 children in 2023/2024. in the first semester during the elementary school teaching course at the Faculty of Education of UNIMED. The research was carried out for 11 months starting from January to November 2023. The following explains the results and outcomes achieved in this research. In this research, a science learning model based on scientific literacy was developed with the learning model name CAPLAIRE (Case Investigation, Plan a Solution, Implementation, Reflection/Evaluation) for Elementary School Teacher Education Department students.

This development study uses the ADDIE model which consists of 5 phases: implementation design analysis development and evaluation.

3.1 Analysis Stage

The activities carried out at the analysis stage are as follows: (a) needs analysis, (b) instructional objectives analysis, (c) student analysis, (d) task analysis, and (e) concept analysis. The following is an explanation of each stage:

A. Needs Analysis

Needs analysis is an investigative activity carried out to determine the learning needs of Elementary School Education Teacher Faculty of Education students, especially in learning science subjects. There are 2 courses that discuss Natural Sciences in the Elementary School Education Teacher Faculty of Education, the two courses are Basic Concepts of Biology and Basic Physical Chemistry as well as Basic Science Teaching and Basic Science Teaching Development which examine the process of teaching basic science.

Currently, the Elementary School Teacher Education Department does not yet have a learning model that is specifically used for the learning process in science courses. The learning process is still focused on mastering science theories, memorizing science material, and solving science questions. There is nothing wrong with this ongoing activity, but based on several facts below, such as:

1. The results of research by the World Economic Forum (2015) in primary and secondary education regarding 21st Century Life Skills. Based on the results of this research, it is stated that 21st century skills consist of 16 skills with three categories: namely basic literacy, competency and quality of character. In order to continue to produce a generation that remains adaptive to current developments, the learning process in the classroom certainly requires a learning model that is able to shape students so that they master 21st Century Life Skills.
2. Scientific literacy is one of the keys to facing various challenges in the 21st century. Mastering and having basic concepts of science and technology will be very helpful in solving life's problems. However, that doesn't mean everyone has to be a science expert. Having and mastering the basic concepts of science allows humans to play a role in making choices that have an impact on life [5]
3. The 2018 PISA results show that Indonesian students' scores are lower than the average scores in OECD countries, ASEAN and a number of countries with characteristics similar to Indonesia, such as Peru and Brazil. Indonesian students' science ability scored 396, which is far from the ASEAN average (433) and the OECD average (488).
4. The findings of multiple studies pertaining to the scientific literacy skills of primary school pupils indicate that these skills remain deficient. Based on the findings of their study on the science process, Dwisetiarezi and Fitria (2021) found that less class V students at SD Negeri 11 Gantung Ciri possessed scientific literacy skills in integrated science learning. The majority of students in the research sample continued to have low scientific literacy abilities, specifically less than 50%, according to Winata et al. (2016)'s analysis of students' initial scientific literacy abilities in Science Concepts. Additionally, a number of research findings support the findings of the aforementioned studies, although they are too many to list in this book one by one.

Based on the facts that happened at the Department of Elementary School Teacher Training, Faculty of Educational Sciences, and some of the facts explained above, we can conclude that the Department of Elementary School Teacher Training, Faculty of Educational

Sciences, UNIMED requires the following: A learning model that focuses on student development scientific skills. A learning model used in the learning process of ``Basic Biology Concepts'' and ``Basic Concepts of Physical Chemistry,'' and a learning model that is directly practiced in the learning process of ``Natural Science Learning'' in elementary school.b) Analysis of Instructional Goals.

Educational objectives are statements of the abilities/competencies that will be acquired as a result of the learning process. Quoted from the speech of the Minister of Education and Culture in the module Support materials for scientific literacy. That is Indonesia as a great country must develop the culture of writing through family schools and community education as a prerequisite for 21st century life. In the year According to the six principles agreed at the World Economic Forum in 2015. Literacy skills are critical for students parents and working adults. “The six fundamental competencies include literacy, numeracy, scientific literacy, digital literacy, financial literacy, and cultural and civic literacy. ” This study focuses on academic literacy.[3].

It's being discussed.The instructional objectives for the science courses at Elementary School Education Teacher Department Faculty of Education UNIMED are as follows:

1. Able to explain phenomena scientificallyMengevaluasi dan merancang penyelidikan ilmiah
2. Interpret data and scientific evidence

The instructional objectives above are the General Instructional Objectives for each science course in the PGSD FIP Unimed study program. Specific Instructional Objectives are adjusted to each course.

3.2 Student Analysis

Elementary School Teacher Education Department Faculty of Education UNIMED students are prospective elementary school teachers who then have the task of guiding students in elementary schools. The characteristics of Elementary School Teacher Education Department Faculty of Education UNIMED students are:

a. Have a different scientific background, namely coming from a high school with various majors such as science, social studies and Indonesian.
b. Obtain learning in 5 fields of study according to the field of study in elementary school while carrying out lectures in the Elementary School Teacher Education Department Faculty of Education UNIMED.
c. Have good ICT competency

3.3 Task Analysis

Task analysis was carried out to find out the types of tasks that must be completed by Elementary school teacher education students, especially in science subjects. The results of the job analysis conducted are as follows :

a. Task analysis was carried out to find out the types of tasks that must be completed by Elementary School Teacher Education Department students, especially in science subjects. The results of the task analysis that has been carried out are as follows.

b. Conduct mini research to uncover natural phenomena or solve environmental problems.
c. Carrying out projects in order to solve environmental problems and innovate.

3.4 Concept Analysis

In this research, concept analysis was carried out to determine the concept of the learning model being developed. In this research, a learning model that adapts scientific literacy will be developed. The concept developed refers to the basic principles of scientific literacy, namely:

a. Contextual, namely in accordance with local wisdom and current developments.
b. Fulfillment of social, cultural and state needs.
c. In accordance with learning quality standards that are in line with 21st century learning. Various activities developed to create a literate student profile, especially in science, can be carried out through a scientific approach. The steps in the scientific approach are known as the 5Ms, namely observing, asking, trying, reasoning and communicating. These steps lead to learning that develops 21st century skills such as critical thinking and problem solving, creativity, communication, and collaboration.
d. Holistic and integrated with various other literacies.
e. Collaborative and participatory.

3.5 Design Stage

The design stage is the stage of designing the CAPLAIRE Learning Model which will be used for learning activities in the Basic Biology Concepts Course for Elementary School Teacher Education students. At the design stage the researcher prepared an initial design of the steps of the CAPLAIRE Learning Model. The following are the results of the design of student worksheets and digital evaluation tools on Basic Biology Concepts material:

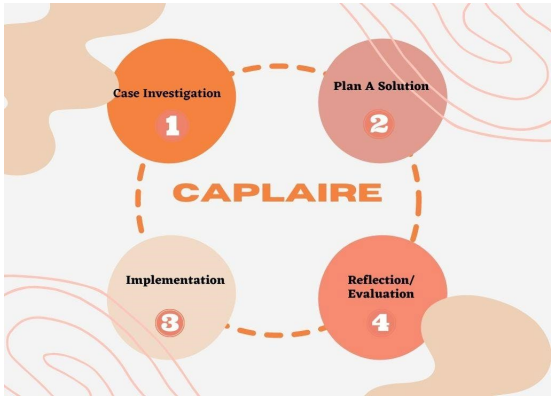

Fig. 1. CAPLAIRE Learning Model based on Science Literacy

The “CAPLAIRE" model consists of four activity steps that are a modification of the problem-based and project-based learning models.. The four steps are: (1) Case Investigation, (2) Plan A Solution, (3) Implementation, (4) Reflection/Evaluation. The term "CAPLAIRE" itself is an acronym for the model activity steps themselves. Through research into the development of this learning model, it is hoped that science learning in the Elementary School Teacher Education Department Faculty of Education will be able to grow and strengthen the scientific literacy abilities of Elementary School Teacher Education Department students and will subsequently produce prospective elementary school teachers who are able to design science literacy-based learning for elementary school students.

More precisely, the goal of the CAPLAIRE model's development was to shape students' scientific literacy skills. A person who is scientifically literate can, as previously mentioned in the chapter,:

a. Able to provide a scientific explanation for occurrences
b. Able to assess and plan scientific research
c. Is able to evaluate evidence and data from science

The characteristics of the CAPLAIRE Learning Model are as follows:

a. Environmental problems are the starting point in the learning process using the CAPLAIRE Model.
b. The issues raised are the result of individual or working group investigations.
c. There is planning in determining solutions to problems.
d. Use various sources to determine steps in determining solutions to problems.
e. There is a hypothesis (temporary guess) regarding the solution to the problem.
f. The existence of an invention in order to determine a solution to a problem, this does not mean a large-scale discovery, a small discovery but provides real benefits for the environment, this is an important point in the CAPLAIRE Model to get students used to creating their own discoveries.
g. The CAPLAIRE model is full of scientific processes, such as: investigation, scientific explanation, data interpretation, data evaluation and scientific proof.

3.6 Development Stage

This development stage is the stage of producing the product being developed. At this stage, the following steps are carried out, namely:

3.6.1 Product Development

At the product development stage, material validation and product design validation are carried out by expert validators. Material validation is carried out on material content, learning model steps, and characteristics of scientific literacy. The following are the results of the validation of the CAPLAIRE Model steps using validation instruments:

Table 3. Validation CAPCLAIRE Model

No	Assessment Aspect	Component	Indicator	Sum of Score	Criteria
1	Content	Course Learning Outcomes	1. Conformity between CPMK and Sub CPMK	5	very worthy
			509284224. Conformity between Sub CPMK and study materials	5	very worthy
			509219376. Conformity of CPMK with activity sheets	4	worthy
			509220048. Suitability of CPMK with evaluation questions	4	worthy
		Material content	509220160. Material completeness	5	very worthy
			509219544. Material Limitations	5	very worthy
			509218592. Appropriateness of the image presentation to the material	5	very worthy
		Activity sheet	509219712. Presentation of HOTS-based activity sheets	4	worthy
			509219824. Provide opportunities for students to practice alone or in groups.	5	very worthy
			509220888. Involvement of students' roles in learning activities	5	very worthy
2	Layout	Layout Design	509220384. Cover suitability with module theme	4	worthy
			509221224. The attractiveness of the presentation of the module	4	worthy
		Sentence Clarity	509221560. Systematic presentation of learning material	5	very worthy
			509221616. Clarity and appropriateness of language use	5	very worthy
			509222624. Conformity of sentence use with Indonesian	5	Very worthy

	language rules		
	509223576. Clarity of instructions for use	5	very worthy
Sub Total =		75	
Persentage =		93%	very worthy

The table above shows that the validation result 93% is very suitable for use in Basic Concepts in Biology course of Department of Primary School Teachers, Faculty of Education UNIMED. However, from the validation process there were revisions/improvements to several parts of the content of the product, which will be discussed in the following section.

3.6.2 Product Revision

At this stage, revisions were made to the CAPLAIRE Model. Revisions are carried out to consider things that are improvements based on comments, suggestions or input, assessments, as well as conducting product trials on students.

3 Conclusion

This research produced a Science Literacy Based Learning Model called CAPLAIRE. CAPLAIRE itself is an abbreviation for the learning stages, namely: Case Investigation, Plan A Solution, Implementation, and Reflection/Evaluation. The product validity test results obtained were 93%, very suitable for use in the Basic Biology Concepts course at the PGSD FIP UNIMED Study Program.

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