Developing a Model of Geography Instructional Materials Based on the Spatial-Ecological Perspectives

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ABSTRACT- The availability of instructional materials which present geographic perspectives is very important in resulting more effective learning of geography. It is completed with factual and conceptual knowledge that are functioned not only as informative sources, but also as organized instructional materials spatially and ecologically. The purpose of this research is to develop a model of geographic instructional materials based on the spatial-ecological perspectives. In order to develop the product, the research design used was the modified model of Borg and Gall design (2006). In the design, there were eight steps implemented to develop the product, namely: need analysis, planning, developing preliminary form of product, preliminary field testing, main product revision, implementing field testing, revision of product, and the final product revision. The subjects of the research were students of Senior High School-SMA10 Malang, Indonesia, and the research validator was a doctor of geography education. The data were collected by in-depth interview and questionnaire. In-depth interview was used to collect data from expert validators, while the questioner used to collect data from the students. The data from expert validation were used for the improvement steps of the model of geographic instructional materials based on the Spatial-Ecological perspectives. Meanwhile, the data from the students were used to determine the feasibility of the produced model. The data were analyzed descriptively and statistically. The results of this research were instructional materials developed based on the Eco-Spatial perspectives. There are six steps as a guide in developing the instructional materials. The sixth steps are: (1) determining the topics of discussion, (2) presenting the location of the phenomenon or object that occurs with maps, (3) presenting an argument of why the phenomenon occurred at the location, (4) presenting an explanations of life forms with the phenomena that occur, (5) presenting an explanation of the natural environment (ecosystem) to the phenomena that occur, (6) presenting an explanation of human life to the phenomena that occur. The results of the field testing show that the average score of the six development steps is 86.45%. Therefore, the instructional materials developed based on the Eco-Spatial perspectives were feasible to be used as reference in composing the geographical instructional materials.

Key words: Geography Instructional materials, Ecological and Spatial perspective

1. Introduction

Instructional materials are one of the most essential elements of the learning system, along with learning objective, learning media, assessment, student and teacher (Ryana, 2010) [1]. As a learning element, instructional materials have a determinant relationship with learning objectives. The availability of instructional materials will enable to present information necessary to achieve learning objectives. Therefore, the existence of the instructional materials in the learning system is very important to create more effective learning outcomes.

Definitions of the instructional materials have been formulated by many educational institutions and experts. Institutionally, some of the educational institutions formulated an understanding of instructional materials. Instructional materials are defined as all of the forms of materials used to assist teachers or instructors in implementing learning process (National Center for Competency Based Training 2007)[2]. A similar understanding was explained by the Directorate of High Schools (2008)[3], confirming that instructional materials are all of the forms of materials used to assist teachers in
conducting teaching and learning activities. Individually, a number of educational experts also formulated the understanding of instructional materials. According to the Harvest (2001 in Andi, 2011)\cite{4} instructional materials are materials arranged by teachers in learning process systematically. Gafur (2004)\cite{5} states that instructional materials are knowledge, skills and attitudes that should be taught by teachers. This understanding is also confirmed by Mulyasa (2006)\cite{6} who believes that instructional materials are knowledge, skills and attitudes that must be learned by students in order to achieve defined standards of competence. Instructional materials are one part of the learning resources which are able to be interpreted as anything that contains learning messages, both intended specifically and generally that can be utilized for benefits of learning.

Based on the understandings, it can be stated that instructional materials are all forms of materials which are prepared by teachers and used as learning resources for students to create more effective learning in achieving the goals or competencies. There are three important things of the sense, namely the organization of instructional materials, instructional materials compiled for learning resources to students, and the ultimate goals for instructional materials to be more effective. The materials should be arranged as conceptual, factual, procedural and metacognitive knowledge. The skills developed can be cognitive, vocational, or technical skills. Growing attitudes can be conducting in both professional and public setting in daily life. Therefore, it can be used as a basis for determining whether or not the learning resources can be categorized as instructional materials.

Instructional materials can be classified into several categories. According to Mulyasa (2006)\cite{6}, instructional materials are classified into printed instructional materials, audio instructional materials, audio-visual instructional materials, and interactive instructional materials. Printed instructional materials can be used in the learning process, including handouts, modules, textbooks, student learning worksheets, models, posters and brochures. According to Koesnandar (2008)\cite{7}, instructional materials consist of two types: (a) instructional materials which are deliberately designed for learning, such as books, handouts, worksheet and modules; (b) instructional materials that are not designed, but can be used for learning, such as clippings, newspapers, films, commercials or news. Based on the function, the designed instructional materials consist of three types, covering presentation materials, reference materials, and self-study materials.

Along with the development of technology, instructional materials have experienced significant development too. Today, with the technological innovation, the development of instructional materials is directed to the virtual instructional materials with the application of increasingly diverse and dynamic technology. Based on the technology used, the Directorate of High School Development (2008)\cite{3} classifies instructional materials into four categories, including printed materials (handouts, books, modules, student activity sheets, brochures, leaflets, wall charts, photographs, and model), audio video materials (cassettes, radio, and audio compact discs), audio visual materials (compact disks and movies), and interactive multimedia instructional materials (CAI-Computer Assisted Instruction, and interactive multimedia compact disc (CD) and web-based instructional materials).

Many efforts to develop instructional materials have been frequently undertaken by teachers individually or groups in professional tasks. One of the materials developments was conducted by the Institute of Quality Assurance and Higher Education in the form of training and mentoring. The development of instructional materials aims to get more effective instructional materials. In general, the feasibility of instructional materials appears from its potential ability to expand knowledge, improve skills, build mindset, creativity, and cultivate constructive attitudes.

No matter the form used, the instructional materials developed should be compiled with good preparation of principles and criteria. There are several principles that need to be fulfilled during the preparation. According to Koesnandar (2008)\cite{7}, there are three principles that should appear, namely: the principle of relevance, consistency, and sufficiency. Instructional materials should be relevant to the achievement of standards competence and basic competence. For example, if the competence expects the students to be able to memorize facts, then the instructional materials that are taught must cover facts or memorization materials. Next, instructional materials should present the principle of consistency. If the basic competence requires the students to master four skills, then the instructional materials that must be taught should include four skills. For example, if the basic competence states that students must be able to understand the operation of numbers including addition, subtraction, multiplication, and division, then the materials taught to the students should also include addition, subtraction, multiplication and division techniques. The third the principle is sufficiency. The materials
taught should be sufficient to help the students achieve the basic competence being taught. Materials should not be too limited, and should not be overflowing. If the materials are insufficient, it will be less helpful to reach the expected competence. Conversely, if the materials are too many, it will be waste of time as the materials may not be necessary to learn.

On the other hand, regarding to the principles of good compilation, the instructional materials must be suitable with good criteria too. According to Furqon (2009)[8], criteria of good instructional materials are: (1) the substances that are discussed should include the body figure of competence or sub-competence which are relevant to profile of graduate abilities, (2) the substances that are discussed must be correct, complete and actual, including the concept, facts, procedures, terms and notations compiled based on hierarchy or stages mastery of competence, (3) the level of legibility, both in terms of language difficulties and substance must conform with the level of learning ability. The criteria are complemented and reinforced by Bandono (2009)[28] who stated that the preparation of printed instructional materials should pay attention to aspects of attractiveness of the display, use language that is easily understood; can grow learning stimulus, and present the characteristics of appropriate instructional materials.

Good instructional materials are not self-composed, but should be developed by the teachers based on good instructional materials preparation to obtain appropriate instructional materials. Unfortunately, in fact, there are many instructional materials which are not suitable with the requirements of good and effective instructional materials. The existing instructional materials in schools have weaknesses that require further improvement and development. In general, the weaknesses mostly cover conceptual errors, less communicative and efficient language, unsuitable depth levels with the required competence, less interesting and communicative designs, and less attention to the perspective of science concerned.

In geography learning, similar problems have commonly occurred. The instructional materials available frequently have weaknesses that need more improvement and development. It is proven by a study conducted by Septi (2016)[9] which shows that there are a number of weaknesses of geography textbooks available. These weaknesses include inaccurate concepts, false concepts, misinformation, scope of textbooks which not match with the curriculum, insufficient instructional materials and less systematic presentation of content, and lack of existing geographic studies. Moreover, Prawindia (2016)[10] also founded similar errors, in terms of language errors, substance, and image used.

Therefore, in order to solve the problem, a good model of geographic instructional materials needs to be developed. There are two important criteria to present a good development model of geography instructional materials. First, the instructional materials should refer to the general principles of developing good learning models. These principles are relevance, consistency, and sufficiency accompanied with an attractive appearance, understandable language, and presence of learning stimuli. Second, the developed model should embrace the geographical characteristics in which spatial and ecological perspectives in learning the phenomena of the surface of the world are presented.

In the spatial perspective, it is stated that “... geography is concerned with spatial dimension of human experience (space and place). The space of earth’s surface is the fundamental characteristic underpinning geography. The essential issue of where‐ness – embodied in specific questions such as, “Where is it? Why is it there?” – helps humans contemplate the context of spatial relationships in which the human story is played out. Understanding spatial patterns and processes are essential for appreciating how people live on the Earth. People who approach knowing and doing with habits of inquiring about where‐ness possess a spatial perspective” (Heffron dan Downs.ed. 2012)[11].

On the other hand, the ecological perspective believes that “...understanding of earth as a complex set of interactive living and non‐living elements is fundamental to know that human societies depend on diverse, small and large ecosystems for food, water, and all other resources. ...connection and relationship among life forms, ecosystem, and human societies process an ecological perspective”. The survival of humans and other species requires viable global ecosystems. Understanding Earth as a complex set of interactive living and nonliving elements is fundamental to know that human societies depend on diverse small and large ecosystems for food, water, and all other resources. People who regularly inquire about connections and relationships among life forms, ecosystems, and human societies possess an ecological perspective. (Heffron dan Downs.ed. 2012)[11]

Therefore, a fully developed geographic perspective involve an integration of both spatial and ecological points of view, as well as a consideration of other related perspectives that may be useful in
understanding and interpreting the world. Thus “where something occurs is explained using the spatial perspective, but how life forms interact with the physical environment is discussed using ecological perspective. We need “both perspectives in order to comprehend earth as the home of people” (Heffron dan Downs ed. 2012)[11].

Based on spatial and ecological perspectives, those approaches should be integrated in the development of geography instructional materials. The instructional materials developed based on spatial and ecological perspectives. The approaches are characterized by: (1) what is the phenomenon of the study? (2) Where is the location and distribution? And how are the distance, scale, distribution, region, and movement? (3) Why does it happen at the location based on the spatial interaction, association, and change over time. (4) how the process of connection and relationship among various forms of human life with animals and plants, between ecosystems, and human society. Thus, in developing geographic instructional materials, we should refer not only to the principles of the preparation of instructional materials generally, but also the characteristics of the geography approach. These general principles are relevant, consistent, and adequate, while specific principles refer to spatial and ecological perspectives. The model of geographic instructional materials based on the spatial and ecological perspectives is illustrated at the following figure.

2. Method

The purpose of this study was to produce a development model of geographic instructional materials based on spatial and ecological perspectives. The development model is steps that are interrelated in a hierarchical manner to reference in composing geography instructional material spatially and ecologically. This research is classified as development research using a design modified Borg and Goll (2006) as the following diagram.
Each steps of the geographic instructional material development can be described in detail as follows:

1) Needs analysis. In developing geographic instructional materials is needed to disclose curriculum and students. Curriculum analysis is to determine the needs of the knowledge and skills, while the student analysis is to determine a knowledge and skills that is needed by students.

2) Planning. The planning of instructional materials is based on the principles of instructional materials development and the characteristics of geography. The principle of development instructional materials relates to principles of relevance, consistency, adequacy, appearance and language. Characteristics of the field of geography is based on spatial and ecological perspective.

3) Develop preliminary form of product. Initial development is done by the team. The development this initial product form in the form of a development model of geographic instructional materials based on the spatial and ecological perspective.

4) Preliminary field testing. Preliminary testing are conducted by geography educators as a expert. Experts are asked to provide opinions to the geographic instructional materials development model that has been drilled in the previous step. This test produces a initial product in the form of geographic instructional material based on the spatial and ecological.

5) Main product revision. Based on the expert opinion, the revision of the development model of instructional materials that have been arranged previously. This step resulted a major product in the form of development model of geographic instructional materials based on spatial and ecological revisions.
6) Playing field testing. Field testing conducted by students of SMA 10 Malang as many as 32 persons of the first grade.

7) Revision of product. Based on the field results testing, revision of the main product has been done.

8) The final product revision. The final result of major product revisions based on field testing is the final product in the form of geographic instructional material development model based on the spatial and ecological perspective.

Data were collected by interview and questionnaire. The interview used in-depth interview to acquire a comprehensive information of the geographic instructional material development model from expert validator. The expert validators are two lectures of geography education of geography Departement Universitas Negeri Malang who have experiences in the teaching more than five years and have masters or doctor level on the geographic education. The questionnaire was used to acquire opinions of the students about the instructional materials development that have been composed based on the six steps of development. There are six questions asked to the research subject. The six questions are:

1) What is the discussion topic have been determined in the geography instructional material development model?; (2) What is the topic has been presented in the geographic instructional material model completed by map? (3) What is the argumentations about the location of the phenomena has been presented in the instructional material?; (4) What is the life forms influence to the phenomena topic discussion has been presented as instructional material?; (5) What is the influence of the natural environment to the discussion phenomena has been presented in the instructional material?; (6) What is the human life influence to the phenomena has been presented on the instructional material?

The answers of the research subject/student to the questions is Yes or No. If the subject answers Yes, they obtain score 2, and if they answers No, they get score 1. Then the score is processed with a formula:

\[
\text{Score} = \frac{\text{Gain Score}}{\text{Total Score}} \times 100\%
\]

The results of calculation was tested with criteria ≥76. If the result is same or more 76, so the development step of the geography instructional material is valid or feasible, and if less than 76 is stated invalid or not feasible. Similarly for the average score, when the average score of the calculation result is ≥ 76, is stated valid or feasible, so it can be used as a reference for development of geography instructional materials. In contrast, when the average score is less than 76, the steps is stated invalid or unfeasible for development of geography instructional material.

DEVELOPMENT RESULT AND DISCUSSION

The result of this development research is mentioned Ecospatial For Geographic Instructional Material Development (EGIMD). There are six steps as a guidance in developing geographic instructional material as follow:

1) Determining phenomena of the discussion topic. The first step aims to determine the phenomena to be studied into a discussion topic. The phenomena can be either natural or non-natural phenomena.

2) Presenting phenomena completed by map. This second step aims to determine and describe the location of a phenomena. The location is explained in absolute and relative terms with a map.

3) Presenting arguments why the phenomena on that location or why the are there. This step is to explain why the phenomena is in that location. The explanation is done thoroughly from various aspects that are related.

4) Presenting explanations of the life form influent to the appearance phenomena and revers. This step is to explain the influence of life forms to the phenomena that occur. The shape of life forms in the form of flora and fauna that form a particular habitat in a region so that it has an influence on the phenomenon that occurs.

5) Presenting explanations of the natural environment effect to the appearance phenomena and revers. This step is to explain the overall ecosystem's impact on the phenomena and its opposite.
6) Presenting explanations of the human life influenced to the appearance phenomena and revers. This step is to explain the effect of human life on the phenomenon that occurs and revers.

The result of the field tests of the learning materials based on spatial and ecological as follows.

| No | Items that be evaluated                                                                 | Score | Regard |
|----|----------------------------------------------------------------------------------------|-------|--------|
| 1  | Determining phenomena of the topic of discussion                                       | 90,62 | Valid  |
| 2  | Presenting location of the phenomena on the map                                         | 90,62 | Valid  |
| 3  | Presenting arguments why the phenomena on that location or why they are there          | 87,50 | Valid  |
| 4  | Presenting explanations of the life form influence to the appearance phenomena and revers| 78,12 | Valid  |
| 5  | Presenting explanations of the natural environment effect to the appearance phenomena and revers | 81,25 | Valid  |
| 6  | Presenting explanations of the human life influence to the appearance phenomena and revers | 90,62 | Valid  |

Based on the 6 (six) steps of the geographic instructional material development model, the highest score is 90,62, and the lowest score is 78,12. The highest score is the step of the determining phenomena of the discussion topic, presenting the location of the phenomena that is completed by maps, and presenting the explanation of the influence human life to the phenomena which is occurred and revers. On the contrary the lowest score is the step of the presenting the explanation of the influence life forms to the phenomena that is occurred and revers. The result of field testing show that all the steps of geography instructional materials development have score was higher than criteria. Thus the steps can be stated feasible as models of geographic instructional material development based on the spatial and ecological perspective.

In more detail, table 02 shows the function of each step in developing instructional materials to produce geographic instructional material based on spatial and ecological. The first step shows a score is 90.62. The score illustrates that the geographic instructional material has been equipped with the topic of discussion. This topic is the result of curriculum needs analysis and students. For example, the topic is "The influence of river to the people life ".

The second step shows the score was 90.62. The score illustrates that the geography instructional material has explained the location of the phenomena being discussed, and the description of the discussion is completed with a map. For example, the Brantas River. The river has a function as a source of clean water for agricultural irrigation, hydroelectric energy sources, recreation and fisheries. The river is also indicated by its location with a map of East Java so that it is known the area of the city and district that passed the river.

The third step shows a score of 87.5. The score illustrates that geography instructional material has been composed providing arguments about the location of the phenomena of the topic of discussion.
In its description, it is presented why the phenomenon is there. For example the eradicate river that flows in East Java. The river flows from the slopes of Arjuno through ten regency and city areas downstream on the north coast of Java.

The fourth step shows a score is 78.12. The score illustrates that the geographic instructional material has been described the influence of life forms on the phenomena that occur and vice versa also explains the influence of the phenomena that take place on life forms. For example, life forms that influence the flow of water on the Brantas river. There are various life forms that affect the river. The forms of life include forest, vegetable farming, rice farming, industry, urban population, and fisheries.

The fifth step shows a score is 81.25. The score illustrates that composed geographic instructional materials have described the influence of the natural environment on the phenomenon that occurs, and vice versa also describes the influence of phenomena on the surrounding natural environment. For example, the flood phenomenon of the Brantas River is made up of the overall condition of the watershed ecosystem, the effect of the Brantas river to the watershed as a whole. The fifth step shows a score is 81.25. The score illustrates that structured teaching materials have described the influence of the natural environment on the phenomena that occurs, and vice versa also describes the influence of phenomena on the natural environment. For example, the flood phenomenon of the Brantas River is made up of the overall condition of the watershed ecosystem, the effect of the Brantas river to the watershed as a whole.

The sixth step shows a score of 90.62. The score shows that structured teaching materials have described the influence of human life on the phenomenon that occurs, and vice versa also presented the influence of phenomena on the natural environment around it. For example, human influence on the Brantas river. Human activities greatly change the condition of the Brantas river. The riverbank area has been narrowed due to population settlements that take up the area.

3. Discussion

The result of this development is Ecospacial For Geographic Instructional Material Development (EGIMD). EGIMD consist of six steps namely determining the topics of discussion, presenting the location of the phenomenon or object that occurs with maps, presenting an argument of why the phenomenon occurred at the location, presenting an explanation of life forms with the phenomena that occur, presenting an explanation of the natural environment (ecosystem) to the phenomena that occur, presenting an explanation of human life to the phenomena that occur.

The result of this development is very useful for the development of future geography instructional materials. So far the development of geography instructional materials does not have a conceptual model based on a spatial and ecological approach as a geographic pillar. The development of geography instructional materials in the form of textbooks, Student Worksheet, and other instructional materials was developed based on general references.

The result of the development (EGIMD) is also make an easier for students to learn. The presentation of instructional materials in EGIMD is conducted in an authentic and contextual manner. Phenomena and/or objects are presented factually and contextually with actual data and information and their relation to life forms, natural environment, and human life. Thus students will get an opportunity to examine actual phenomena and their relevance to other influence phenomena. This perspective is in line with the new approach to geography learning (Boema *at.all*, 2018)[30] that geography learning will be easier with a "bottom up" approach where students can interact from the begining with the phenomena or object being studied.

In addition, EGIMD will also develop capabilities in spatial thinking, critical thinking, analytical thinking, and geographical skills. Spatial thinking is the individual's sensitivity in linking objects to each other in a space. Masykur (2007)[13] argues that spatial ability is related to one's ability to comprehend more deeply the relationship between objects and space. Spatial thinking is an abstract concept consisting of spatial perception, spatial orientation (Tambunan, 2006)[14], spatial orientation, spatial location, spatial visualization, and spatial perception (Veles, 2011)[27], include spatial relation, spatial orientation and visualization (Lohman, 1993)[15]. The EBL is not only a collection of knowledge or information, but the knowledge or information is arranged in spatial thinking. The phenomena is explained its location on the map, and it is also explained why the phenomena is there from various perspectives.
Critical thinking is the ability to identify and formulate a problem, to determine similarities and differences, to extract relevant information and data, to consider and evaluate opinions and facts, to find assumptions, to separate prejudices and social influences, to obtain consistency in thinking, and to draw conclusions that can be justified based on relevant data, and estimate the consequences that will arise (Winkel, 2007) [29]. Ennis (1991) [16] states that "critical thinking is reasonable reflective thinking that is focused on deciding what believe or do". Critical thinking includes the ability to formulate problems, argue, deduce, induce, evaluate, and decide and execute. According to Edgen and Kauchak (2012) [17] express that critical thinking is the ability and tendency to make and evaluate conclusions based on evidences. Halpen (in Hassoubah, 2004) [18] states that critical thinking needs to be developed in order to solve problems, formulate conclusions, gather possibilities, and create appropriate contexts and types. The EBL model are conceived based on the critical thinking paradigm. Presentation of information is followed by ongoing problems, arguments of the problem, and deductions or inductions from geographical concepts. Thus the learning materials can cultivate critical thinking skills to the student who learn.

Analytical thinking is the ability to break down a problem into smaller parts and be able to understand the relationship between the parts (Suherman and Sukjaya, 1990 [19]; Asani, 2012[20]). Rose (2002) [21] state that analytical thinking ability can be viewed from thinking problem-solving, that is defining exactly what the real problem, have many ideas, get rid of the least efficient alternative and discard options that do not meet the criteria that have been predefined, determines the ideal option by looking at the best solution that meets the specified criteria, knowing the effects and impacts in solving the problem. King et al. (1997) [22] argue that analytical thinking is influenced by the individual's ability to apply, re-masters, and add knowledge to the situation or environment in which the individual is situated. According to Sudjana (2005) [23], Herdian, 2010[24]) the analytical skills include: (a) classifying words, phrases, or questions using specific analytic criteria. (b) foresee certain specific properties not mentioned clearly. (c) can forecast implicit qualities, assumptions, or conditions, or that need to be based on the criteria and material relationships. (d) presenting the pattern, arrangement, or arrangement of the material using criteria such as relevance, causation, and prosecution. (e) recognize the organization, organizational principles, and material patterns it faces.

Analytical thinking includes the ability (1) to give reasons why an answer or approach to a problem is reasonable. (2) analyzing statements and providing examples that can support or contradict. (3) using supporting data to explain why the methods used and the answers are correct. (4) create and evaluate general conclusions based on inquiry and research. (5) forecasting the conclusions or decisions of the appropriate information. (6) consider the validity of the argument by using inductive and deductive thinking (Ross in Rohayati, 2003) [25]. The EBL models can cultivate analytical thinking skills. In the learning materials there are examples of spatial and ecological analyzes and exercises. Student involvement in practicing problem analysis can improve their analytical skills.

Geographical skills include the ability to compile geography questions, collect data, associate data, analyze data, and communicate information (National Erdowment for the Humanities 1912) [26]. Geography skill is the goals of geography education in addition to knowledge and attitude. In the EBL there is a problem formulation activity, data collection, data organization, data analysis, and communicating data analysis that can improve geography skills of student.

4. Conclusion

Geography instructional materials can be developed spatially and ecologically (ecospatial). To develop ecospatial geography instructional materials there are six steps, namely determining the phenomenon of discussion topics, presenting the location of phenomena on the map, presenting the arguments of phenomena location why there are there, presenting explanations of the life forms influence to the appearance phenomena and reverses, presenting explanations of the natural environment influence to appearance phenomena and reverses, presenting explanations of the human life influence to appearance phenomena and reverses. The six steps have an average score is 84.37 higher than the criteria score is 76. Thus the six steps in the development of geography instructional materials are appropriate to be used in developing geographic instructional material based on the ecospatial. As an implication, if the development model is applied there will be changes in geography instructional materials. The composed geography instructional material will be easier for students to learn, because it presents a concrete, contextual and completed a map. In addition, there are associations with life
forms, natural environment, and human life so that it can foster spatial thinking, critical thinking, analytical thinking and geographical skills.

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