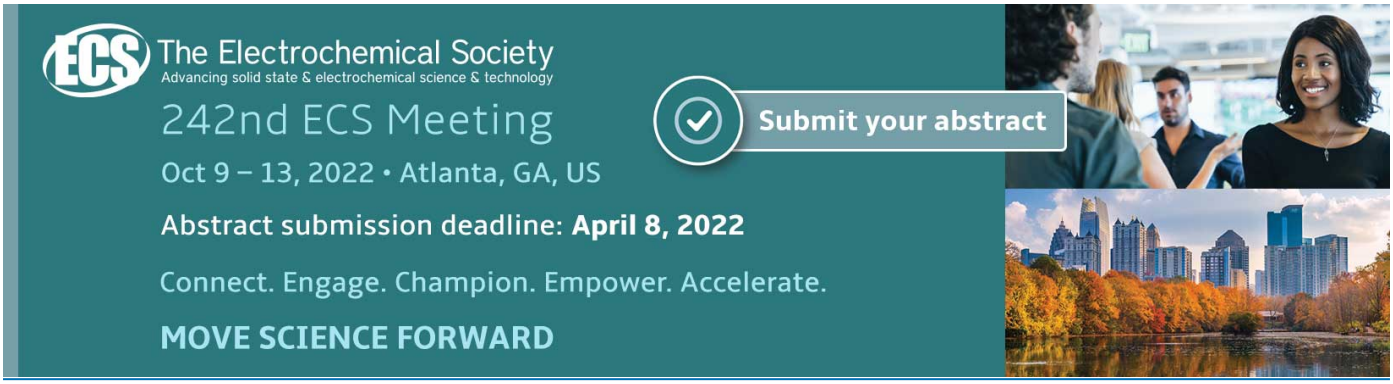
# Analysis the Syntax of Humanistic-Algoritmic-Heuristic Science Learning Model





IOP Conf. Series: Journal of Physics: Conf. Series **1028** (2018) 012208 doi:10.1088/1742-6596/1028/1/012208

# Analysis the Syntax of Humanistic-Algoritmic-Heuristic Science Learning Model

**Sudarto & Sitti Rahma Yunus**

Science Education Department, Universitas Negeri Makassar, Makassar, 90221, Indonesia

drsudartompd@gmail.com

**Abstract.** This paper explained in detail the syntax of the Humanistic-Algorithmic-Heuristic Science Learning Model. It was obtained through research and development. In this model, there were seven syntaxes that science teachers ought to do in teaching science in the classroom. The seven syntaxes were: (1) describing the objectives of science learning humanistically, (2) generating the leaners' learning motivation humanistically; (3) leading the learners to understand the science contents in humanicstic-algorithmic-heuristic; (4) giving guidances to the learners to master the science contents humanistically by thinking algorithmic-heuristic, (5) grouping the learners based on their temporary understanding humanistically, (6) evaluating the leaners' final understanding humanistically, and (7) giving a task to the leaners in humanistic-algorithmic-heuristic suitable the science contents that the learners have learned. This science learning model can be a choicing to the science teachers in teaching science so the science is fun for the learners and leads to improve the learners' learning outcomes.

## 1. Introduction

Science subject is a subject that very related to the technology and technology is very related to the progress of a nation. Therefore, the advancement of a nation depends on the nation's technological progress and it means also depends by the nation's science.

An agenda of science learning is how to teach the science so the learners like it and the leaners' science learning outcomes are also getting better and better. This agenda is consistent with the function and objectives of Indonesian national education listed in section 3 of the rule of Indonesia National Education System Number 20, year 2003. In this rule, it's stated that the national education of Indonesia serves to develop the ability and form the character and civilization of the leaners in educating the national living and it aims to develop the learners potential maximally.

Thus, it is seen that through the national education of Indonesia is expected to form a high quality Indonesian people: in material and spiritual. In other words, the goal of Indonesia's national education is increasing the intelectual, emotional and spiritual intelligence.

The leaner perception that science is difficult must be responsed seriously. Author has interviewed some leaners of junior high school related the science lessons and the results of the interviewing was

obtained data that a hundred percent of learners consider the science lesson was difficult. On the other side, they also assume that their science teacher never make them love the science lesson.

The reality of the leaners' perceptions above is consistent with the data of the Indonesian children's science abilities in international arena, both from the results of tests conducted by TIMMS so by PISA.

To overcome the case, the authors apply a model of science learning that pleases the learners and leads them to improve their science learning outcomes so be better and better. From authors, this science learning model is called science learning model based on humanistic-algorithmic-heuristic.

This science learning humanistic leads the learners learn the science happily. The science learning in algorithmic and heuristic deliver the learners on the science learning process with the minds pattern trace and not trace. This mindset leads the learners to understand the science by optimalizing their brain work.

On the humanistic science learning, Sudarto and his friends [1,2,3] have conducted a research and produced humanistic science learning tools. This device strongly supports the formation/development of intellectual, emotional, spiritual and creative potential of the learners. By developing a science learning model based humanistic and applied the humanistic science learning tools and assembled with the development of algorithmic-heuristic thinking skills, we are expected the learners' characters more easily formed and cultivated as well as and the science competence of the learners are increasingly skyrocketed as well.

Humanistic Science Learning will make also the learners be happy because in this learning the leaners they will be treated humannistically. By the sense of happiness, we expected the student's enthusiasm more increase and more increase . This matter is consistent with the statement of Kapuskom Kemendikbud Ibnu Hamad: "by glad and happy in the class, the children can resch thr high science lerrning outcomes (The President Post/Online Newspaper, published on December 8, 2013, accessed on March 23, 2015).

Science is concerned with the way to know about nature sistematically, so science is not just the mastery of a knowledge collection in form of facts, concepts, or principles, but also it is a discovery process (National Education Department/NED, 2003).

In general, the essence of science can be expressed as an organization of knowledge, a part of progressing and human creativity (Science is developping), searching for findings (Science as a process), science disciplines and processes, and competitive efforts, the popularity of scientific knowledge is concerned directly with the prestige of the person who discovers that knowledge. The ease of the scientist accepts the knowledge directly related to how to close the paradigm (research program and others) to another paradigm of knowledge[4]. Science can also be said as a searching process (investigation), a collection of values, a way of getting to know the world, social institutions, and parts of the everyday living.

Science Education emphasizes on the experience giving directly to develop the leaners' competencies so they are able to explore and understand the surroundings naturally. Science Education is directed to find out and conducts so it can help the learners to gain a deeper understanding of the natural world. (NED, 2003).

Furthermore, to implementate the science learning in the schools, we should consider several things, including: science inquiry, problem solving, science-environment-technology-society, science learning is fun, and the science learning.based value[5].

By looking at the explanation above, it can be drawn a conclusion that Science and Science education rely on nature where the learners become "candidate of experts" associated with the nature. The Humanistic-alghoritmc-heuristic science learning model is an approach to bring the learners to the goals and objectives thar we are expected.

Man is a subject or person who possesses a creating, taste, and intention, who understands and realizes his existence, who can govern, determine, and control himself, has a mind and willing, has an impetus to develop his better and more perfect, person who is looking for his identity [6]. In his personal development and improvement process, the man only can forming, developping, and

perfecting himself. A person can not perfect others, but others can do to us are maybe helping, creating a conditions and opportunities that enable us to grow by experiences.

The learning science becomes humanistic when the teachers recognize and locate or treat the learners as subjects or individuals who possess the above-mentioned traits and the recognition is manifested in the learning process, which gives the learners the widest possible opportunity in a reasonable context in order to they can develop themselves so that his potential, personality, and attitude develop into a better and more perfect level. This means that it must be a humanization process of the human, it must be an educational process. The learners are treated as subjects who have a role, can organize their activities, not as an object solely that everything is determined by the teacher.

Thus, the education here can be interpreted as humanity of young man, the increasing of young man to human level, helping and giving guidances for the children who are walking towards the more perfect human [7 and helping the learners to find their humanity values [8].

What is the illustration of science learning based humanistic? The science learning based humanistic is: (1) the learning science that leads the learners to build their own correct conception and definition instead of informing them, (2) the science learning which process and attitude is formed through process, not through information, (3) the science learning that use demonstrations as a problem generators, (4) the learning scienc that using demonstration as a first step in constructing the conceptions, (5) the learning scienc that using demonstrations as an evaluation of the truth conclusions, (6) the learning scienc that using demonstrations as a generator of motivation (7) ) the learning scienc that using a finishing of sums systematically.

An algorithmic strategy is a strategy that has a certain set of processes and remains in performing one task [9]. Furthermore, Landa [10] says that the process of thinking algorithmic is a thought process consisting of a fundamental operations series that are formed uniformly and regularly under the conditions that are defined to solve various problems. The recipes that define operations in an algorithmic process are called algorithms. All operations must be carried out systematically following the prescribed sequence. If there is a step that is not done or there is a mismatch in the order of completion steps, then the problem solving is not found.

Generally, algorithms are based on procedures that are defined to lead to one goal [11]. The algorithm is dominated by a conditional statement: if the condition is then the consequences. The same situation occurs in learning with algorithmic learning strategies. The algorithmic learning strategy focuses on mastery of certain criteria or attributes that consistents with the expected conditions.

Exercise on algorithmic learning strategy is done with a guided approach. Initially, the learners are given a matter of practice and accompanied by a rather detailed workmanship instructions. Based on the instructions, the learners do the exercises. If the learners are able to do so, then the next problem instructions gradually reduced. In the end, the learners are expected to be able to do the exercises with a good job even without the accompanying instructions workmanship. The guided exercise approach is based on the concept of associative shifting exercise from Thorndike [12]. The theory of associative change recognizes that the response of a stimulus can be increased to other stimuli. At first, a very strong stimulus causes the individual to be able to perform the activity. If the stimulus repeats itself, albeit with a weaker intensity, the individual will tend to be able to perform the same activity.

Heuristics is one of the most important thinking skills possessed for understanding the science. Many definitions are expressed by experts on heuristics. The definitions are as follows:

(1) Heuristics is a resourcefulness in working or practical guidance that can help shorten the problem-solving paths [13].
(2) Heuristics is a cognitive shortcut that can prepare carefully the accurate way to all individuals at all times [14]. Rationale or the cognitive shortcut is used to guess where does something should be begin and where does have to jump so that the problem-solving step becomes shorter and more precise.
(3) Heuristics shows the combination of strategies, practical guidance, guidance, or mutual advice to solve the problem [15]. The interdependent conditions emphasize that a combination of strategies, practical guidance, guidance, or suggestions used in solving non-permanent problems, both in

numbering and in ordering. The perpetrator has the freedom to decide where have to begin the process and determine what process should be done follows.

(4) Banathy [16] says that heuristic thinking systems are capable of setting goals under broader, widely varying policy guidelines, open to changes and even frequent initiation of change, and have a very dynamic complexity. In other words. the complexity of the heuristic process as a very dynamic thinking system and the operations within them are very open to the changings.

There are several approaches that are often used in instructional teaching or emphasizing heuristic thinking skills, such as: backward approach, analogy approach, goal-breaking approach, and approach to minimize differences. Approach to thinking or working backward in solving problems is done by giving problems to children where problems can be solved without giving preliminary problems. For example, in learning dencities, the child is immediately given the problem of determining the density of the mixture by two or more substances mixed. Not through the problem of calculating the density of a substance. If the problem is solved directly, so the process of mastery the material with the topic "dencities" is declared to have mastered the leaners. Conversely, if the problem can not be solved by the leanersso it must be formulated some step back in detail to solve it. Similarly, in conducting psychomotor-related activities, leaners are instructed in such a way that clues are brief and concise (many clues are not mentioned). If the short, concise clues are not yet elaborated, they are detailed in the future. For example in conducting experiments to prove "air has mass" it is given a brief and dense clue of "do experiment to prove that air has mass!". If the child is able to do it then the learning is considered successful. If the child has not been able to do the experiment to prove that the air has mass with the instructions, so the instructions are parsed forward, eg "design experimental steps to prove that air has a mass". If not yet,so make more detailed the instructions, for example: "prepared tools and materials ... .frame ..., and so on until the experiment can be done. By giving science problems that require solving combinations of algorithmic and heuristic thinking, leaners will more easily to master or understand the science, both in cognitive so in psychomotoric because indeed to master or understand the science, we need the thinking skills required.

Based on the above description, the research question is: "How is the syntax of the science learninfg based humanistic-algorithmic-heuristic that can generate the character and boost the cognitive-psychomotorics abilities of the learners in science ?".

## 2. Method to Get the Model and Its Syntax

To get the model and its syntax, we got a research: research and development. The developed was the science learning model with the main foundation of learning that was fun, humanizing, educating and increasing, that was the science learning based on humanistic-algorithmic-heuristic. This model was developed through certain stages. The stages were as the steps introduced by Thiagarajan [17] was knew as Four-D model (defining, designing, developping, and disseminating).

## 3. The Syntax of Humanistic-Algoritmic-Heuristic Science Learning Model

The syntax or steps of Humanistic-algoritmic-heuristic science learning model as follows:
Step 1: Explaining the goal of humanistic learning.
Step 2: Awaking the learners' motivation to learn humanly.
Step 3: Getting the learner to understand the material in an algorithmic-heuristic way.
Step 4: Providing guidance to the learners in mastering the material by thinking algorithmically-heuristically.
Step 5: Classifying the learners based on the temporary understanding.
Step 6: Evaluating the final understanding of the learner.
Step 7: Delivering a learning task in humanistic-algorithmic-heuristic.

Explanation of the seven steps above were as follows.
Step 1: Explaining the goal of humanistic learning.

The goals of humanistic learning were different from those of ordinary learning. The goal of humanistic learning seeks to always touch all aspects of the humanity of learners. Hence, the goals of humanistic learning include the goals of intellectual, emotional, and spiritual development. The purpose of intellectual development related to the mastery of the science material. In this intellectual development. the learners were brought to the conditions of how they comprehend the science comprehensively on the topics covered. The purpose of emotional development was related to attitudes or characters that should be established or held by the learners after learning. The characters developed in learning were the main characters and urgent to be noticed. The purpose of spiritual development concerns how to developed the attitude of learners that led to the ability to put behavior and life in the context of broader and more rich meanings, and had the belief that there were forces beyond the more determining human power.

Step 2: Awaking the learners' motivation to learn humanly.

For generating the learners motivation in learning the science humantically, the provision of motivation was done by taking into account the sides of the humanity learners. The sides of humanity include: the learners wanted to be respected, the learners wanted to be recognized, the learners wanted to be determined in to the right way, the learners did not want to be harassed, and the learners did not want to be reproached. Therefore, to generated the leaners' motivational in learning, we as a science teacher had to did the following ways:

(1) Appreciate anything that can be appreciated on self-learners.
(2) Acknowledge the existence and ability that owned learners.
(3) Show the right things on learners
(4) Never harass and criticize the learners.

Step 3: Getting the learner to understand the material in an algorithmic-heuristic way.

If we had seen the leaners had a high motivation to learn so next step was we lead the learners in understanding the material. In getting them to understand the material, we gave them a set of SLS (Student Learning Sheet). Let them learn through the SLS. In this SLS, the learners was trained to understand the material in an algorithmic and heuristic way.

Step 4: Giving a guidance to the learners in mastering the material by thinking algorithmic-heuristics.

In this step, we gave a guidance to the learners who needed a guidance or needed to be mentored. We guided the learners with affection. We did not guide them angrily. We guided in such a way that we used could be a trigger for the development of leaners' intellectual, creative, emotional, and spiritual abilities. We make ourselves as a major learning resource and change for the leaners to a better way. Attitude, speech, mimic and all our behaviors became inspiration for the learners to change them better and better.

Step 5: Classifying the learners based on their temporary understanding.

We grouped the leaners according to their difficulty level in understanding. To see their difficulty level, we saw their working or their answers on SLS: on the problem or sums where they did not have difficulty experienced. The leaners who could not afford the same problem were grouped into one group. We gave a guidance to each group in solving the problems that they did not understand yet. If all learners had been able to understand the material reflected from their work in the SLS, so we gave them an evaluation.

Step 6: Evaluating the final understanding of the learner.

Evaluation was done related to the material that had been learned the learners. The number of questions in the evaluation was same as the number of problems or sums in SLS.

Step 7: Delivering a learning task in humanistic-algorithmic-heuristic.

The task of this humanistic learning concerned with the material that has been learned by the learner and it was enriching and in this task there was emotional, spiritual and creativity that are developed for the learners.

## 4. Conclusion

From this research, it was obtained a science learning model based on humanistic-algorithmic-heuristic consisting on seven syntaxes or steps. The seven syntaxes or steps were as follows:
Step 1: Explaining the goal of humanistic learning.
Step 2: Awaking the learners' motivation to learn humanly.
Step 3: Getting the learner to understand the material in an algorithmic-heuristic way.
Step 4: Providing guidance to the learners in mastering the material by thinking algorithmically-heuristically.
Step 5: Classifying the learners based on the temporary understanding.
Step 6: Evaluating the final understanding of the learner.
Step 7: Delivering a learning task in humanistic-algorithmic-heuristic.

## REFERENCES

[1] Sudarto Natsir M 2008 *Pengembangan Perangkat Pembelajaran Sains Berbasis Humanistis* (Laporan Penelitian). Lembaga Penelitian Universitas Negeri Makassar
Sudarto Natsir M 2009 *Pengembangan Perangkat Pembelajaran Sains Berbasis Humanistis* (Laporan Penelitian) Lembaga Penelitian Universitas Negeri Makassar
Sudarto Natsir M 2010 *Pengembangan Perangkat Pembelajaran Sains Berbasis Humanistis* Lembaga Penelitian Universitas Negeri Makassar
[2] Supriyono 2003 *Strategi Pembelajaran Fisika* Malang JICA
[3] Nurhadi 2004 *Kurikulum 2004 Pertanyaan dan Jawaban* Jakarta: Grasindo
[4] Drijakara 1978 *Filsafat Nanusia* Yogyakarta: Kanisius
Drijakara 1980 *Filsafat Nanusia* Yogyakarta: Kanisius
[5] Hartoko D 1985 *Memanusiakan Manusia Muda* Yogyakarta: Kanisius
[6] Dansereau 1985 *Learning Strategy Research*, *Thinking and Learning Skills* ed. Judith S Susan FC and Robert G Hillsdale: Lawrence Erlbaum Associates Publishers
[7] Landa L N 1983 *The Algo-Heuristic Theory Of Instruction* ed. Charles M Rigeluth *Instructional-Design Theories and Models: An Overview of their Current Status* Hillsdale: Lawrence Erlbaum Associates Publishers
[8] Gabringer R Scott David J and Brent G W 1992 *The Use of Expert System*, *Handbook of Human Performance Problems in Organization* San Francisco: Joseey-Bass Publishers
[9] Lefrancois 1995 *Theories of Human Learning* Kro: Kro's Report
[10] Wilson, BG and Peggy C 1996 Cognitive Teaching Models" *Handbook of Research for Educational Communications and Technology* ed. David H, New York: Simon & Schuster Macmillan
[11] Vaughan G and Michael H 1995 *Introduction to Social Psychology* Sydney: Prentice Hall
[12] Amstrong T 1994 *Multiple Intelligences in the Classroom* Alexandria: Association for Supervision and Curriculum Development
[13] Banathy Bela H 1996 *Syatem Inquiry and Its Aplication in Education, Handbook of Research for Educational Communications and Technolog,* ed. David H New York: Simon & Schuster Macmillan
[14] Thiagarajan S Semmel D S and Semmel M I 1974 *Instructional Development for Training Teachers of Expectional Children* Minneapolis Minnesota: Leadership Training Institute/Special Education University of Minnesota