Methodology

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Abstract. Naturally, human do the search for truth in various ways. All of that becomes methodological, but not a methodology. The right way and produce truth by involving the principle of believing the truth, getting a way, and having a purpose. So, its not justification. Three basic principles of methodology are not enough. However, the methodology becomes the method science, it needs to be systematic that flows the truth logically, and needs a structure to form the truth logically. Thus, abstraction is helped by rules or formulations that describe the structure, at least from the point formation, as definitions, lemmas, propositions, theorems, or corollaries.

1. Introduction
Naturally, human use reason and thought, its produce as knowledge or/and ways to get the truth about something [1]. The meaning of combination two words ”knowledge” and ”way” is what we call as methodology [2]. The truth of something depends on the studied reality both physically and non-physically [3]. Doing it for the truth is searching in a certain manner, systematically and structured [4].

Methodology aims to gain knowledge through certain means [5]. Even so, the methodology does not give birth to a science and also cannot influence a science, because the methodology becomes a integrated part of the science itself [6]. It can as a separation part independently in the study of specifics about the method [7]. Thus, this paper will describe a little about the methodology, which applies generally or through a specificity to express the principles that build the methodology.

2. A review as the basic concept
Trivially, the methodology is based on the assumption that truth exists, whereby doubting that truth and its existence is not truth [8]. Technically, the methodology is composed of structured ways to gain knowledge. However, before stating the methodology explicitly it is better to express this term clearly, even though the word ”methodology” is to name it, in fact the concept behind it needs to be understood [9].

The term methodology comes from a combination of words from Greek, namely metha, hodos, and logos. The first word means ”through” or ”past”. The second word means ”way”. Whereas the third word means directly as ”science”. The first two words construct the word methodos (in Greek) or the method (in English) [10]. The last term is to express the taking path to reach the goal. The goal is truth, so knowledge need to get that truth and to understand it [11].
Well, we use the word "methodology", although it’s possible to change it by using other terms. The term to mean the same thing. In general, this term has the abstraction as follows: Suppose $f(\tau, \pi, \gamma)$ as a methodology, $\tau$ declare the truth, $\pi$ as a way, and $\gamma$ represents the goal. Thus, relationship that might form as follows.

$$f(\tau, \pi, \gamma) = \tau + \pi + \gamma$$

where the formula gives generally a description that methodology = truth + method + purpose. In this case, it is in depth that the methodology depends specifically on the truth. Truth is the difference between something and the other. Distinguishers contain the features or characteristics of something, which classify something towards something [12, 13, 14].

For example, logic groups statements into two parts, namely as sentences that are false in reality or true sentences based on reality. In other words, logic regardless of methodology gives a false (F) value or a true (T) value to each statement, but methodology logically distinguish the statements into two different parts [15, 16]. It is conceptually, like expressing membership in a set, when the set is a reality [17]. A reality that real numbers, for example, are in the range of $-\infty$ and $\infty$. It is characteristic for the inclusion of something in something. Suppose $r$ is any real number, $r$ express a number where writing it in decimal form in a range, that is $-\infty \leq r \leq \infty$ or $r \in [-\infty, \infty]$. For example, $r = 1.0, r = 0.111, r = 3.14 \ldots$, etc. The feature $-\infty \leq r \leq \infty$ states that any real number $r$ is in a closed range with the smallest limit of $-\infty$ and the largest limit is $\infty$, a notation $\leq$ is the operator of submission which gives the meaning of any number. We can replace the writing pattern of $\leq$ by another pattern, which involves the brackets [ , ], and ∈, where the notation ∈ is a notation of membership in the closed range of [ , ]. Assuming, if $r$ is true (value T) is in the range of $[-\infty, \infty]$, then $r \in [-\infty, \infty]$ is worth T as its state. Conversely, if $r$ is incorrect (value F) in the range of $[-\infty, \infty]$, that is $r \in [-\infty, \infty]$ is worth F, or $r \not\in [-\infty, \infty]$ is worth T as its states. Furthermore, we can define a set of real numbers as $R = \{ r | -\infty \leq r \leq \infty \}$, by which $R$ is to abstract symbolically the set of real numbers. While $\{ r | -\infty \leq r \leq \infty \}$ parses them by involving curly braces { and } and explains them with $-\infty \leq r \leq \infty$. In this case, the definition is to emphasize the reality in which truth exists [18].

In the world, either of education, research, and community service, the universe of discourse requires a methodology to meet the many interests of the stakeholders for life [19, 20]. Nature and its contents and living things need balance and it requires methodology [21]. The occurrence of damage everywhere requires a methodology to fix it. Thus, the methodology we need so that justification of true is truth, not justification only, so that application of the methodology can carry out for the survival itself [22]. The methodology that applies to the universe of discourse start with logic that ensures that truth exists. For this logic, the set with the scope of description logically proposes the concept of membership [23]. The environmental description based on the characteristics or their details. Thus, the general methodology for separating the truth from the error based on what is true naturally [24].

Furthermore, with this concept, the application range of the universe of discourse can take shape, and it is by giving classification. The universe of discourse contain the information source as the object of explanation, where the classification based on condition that provide defining concepts [25]. Generally, classification applies only to parts of the universe of discourse, which are sometimes we refer to as samples. Manually, the population has not been able to prove itself to be unreachable, and the sample can only be representative when fulfilling certain conditions. Therefore, when we assume the information source by describing the state of the population as a whole, clustering becomes a method for differentiating populations according to the interests of the classification method [26, 27]. It is what we mean by methodology.
3. Toward Method
To distinguish one reality from another reality generally use their characteristics. In this case, the characteristics are proof for grouping systematically the realities into one category or a set [28]. As in the beginning, it gives a difference to reality based on logic, as in Fig. 1. Next, by placing characterization as conditions, difference be real. Based on that, for example, there is a $x_1$ as a characteristic for each membership of $r \in \mathbb{R}$ or briefly $\exists x_1 \forall r \in \mathbb{R}$. It gives a different position about the logic and the set, but still in the same intent. The concept of set is stronger than the concept of categories [29]. However, by adding the characteristics of $x_2$ as a differentiator for the number $r$, for example, intend that $r$ has the writing in the form $a$ or $a/b$ or only the writing in endless decimal form like $a.bcde\ldots$, a set of rational numbers $\mathbb{R}$, therefore $Ir$ also as a set of irrational numbers will form itself. Of course, logically the rational numbers can also separate into two forms of writing, namely the form $a$ as an integer and the form $a/b$ as a fraction. The sets of number are arranged in a structure like Fig. 2, which explains that the presence of features to form the differentiator that classifies reality into categories logically.

Adding conditions to the set is not to separate realities into truth or untruth, characteristics as conditions are presented to justify that there is reality in accordance with the group. Therefore, the foothold method as a methodology resets on a definition that summarizes all the characteristics for a systematic reality. When stated a category or set exists, axioms form a method structure like Fig. 1 so that reality is logically valid. Thus, there is only one category of
reality that is truly in the truth for all the characteristics that support one another, the others are in an incorrect position.

The logical, systematic, and structured side states that the methodology is to justify the truth of a reality. Logic has sorted out something with T and F, and categories as a cause of logic also sort things continuously and keep into T or F. Always when adding characteristics to categories will sort deeper into reality in T again, and so on. Thus, the logical category F value follow the series: $s_1 = \frac{1}{1} + \frac{1}{4} + \frac{1}{8} + \cdots$, while the logic category T follow the series: $s_2 = \frac{1}{1} - \frac{1}{4} - \frac{1}{8} - \cdots$. Categories of reality based on truth are like Fig. 3, where $1 - s_1$ for F or $1 - s_2$ for T. It means that the truth always leads to the nature of the truth, called the core, or the source of the truth, even though the truth is in every reality. Whereas the cumulative amount of reality that is related to true or false value based on incremental conditions.

Furthermore, deciphering the characteristics of truth by converging reality and its characteristics into axioms will form a characteristic set, not just a set only.

3.1. An example: a group

Take for example related to algebra, especially group theory which is always used as a tool to homogenize reality based on the properties that apply. Suppose there is a set not empty $G$, or $G \neq \emptyset$ [30, 31, 32]. A binary operation $*$ applies toward $G$ so that

S1: $\forall a, b \in G, a * b \in G$.

In other words, for a pair of members of $G$ there is one member of $G$ representing both, or the application of a closure axiom to $G$ and $*$. It states that $(G, *)$ is groupoid [33], a different category from $G \neq \emptyset$. By adding another condition (the second axiom) to $G$ and $*$, that is the associative applies for $*$, i.e. naturally that

S2: $\forall a, b, c \in G, (a * b) * c = a * (b * c)$.

The term for the set with this membership category is semigroup [34]. Added characteristics to $G$ such as the following third axiom,

S3: $\forall a \in G, \exists e \in G, a * e = a = e * a$.
states that \( \langle G, * \rangle \) is *monoid* [35]. Meanwhile, if \( G \) and \(*\) satisfy the fourth axiom

\[
S4: \forall a \in G, a^{-1} \in G, a \ast a^{-1} = e = a^{-1} \ast a
\]

Categorizing \( \langle G, * \rangle \) as a *group* [36]. The axioms perfect the definition as a methodology in expressing a science according to theory, as the presence of *Group Theory*. So, a methodology exists as part of science itself, because it has never existed as a method science.

### 3.2. Systematics, structure, and abstraction

The methodology, is this case, becomes a different form of the concept of logic, although categorization also involves logic, and it is referred to as *systematics*, namely the existence of a correct flow of truth by involving several statements with values of true [37]. Whereas the forms which logically categorizing are axioms that apply in methodology, and it is referred to as *structure*. Methodology in something, as a hexagon structure, for example, is presented from one point to another point in the flow of information: There are 6 (six) points with the same distance; Each pair of point is connected by a line; So, there are 6 (six) lines as sides. Then, the hexagon is evaluated by: For opposite sides, if a line is drawn from each end in a cross, a center point is formed right in the middle of the hexagon, and there is only one center point or called the center point. If there is more than one central point, the hexagons are not in the correct structure. So in methodology, the flow of information is in line with the formation of structure.

Conceptually, the \( t \) points negate the line, or the point itself becomes a line. With that in mind, if there is a point \( t \), then there is a line \( l \). In this case, \( |t| = |l| \), by which \( |\cdots| \) denotes size, in presenting a form. Furthermore, for 2 (two) points \( t \), there is only one (straight) \( l \) line connecting the two points, or \( |t| \neq |l| \), and it invalidates the assumption that \( |t| = |l| \) applies to all. In other words, suppose a shape, then there are \( n \) points \( t_i, i = 1, \ldots, n \) and \( m \) line \( l_j, j = 1, \ldots, m \). As a methodology in abstraction, the hexagon is stated as follows:

**Definition 1.** The hexagon shape, written \( S_h(t, l) \), is a form constructed from \( t = 6 \) (six) dots and \( l = 6 \) (six) lines whereby dots have the same distance as one central point.

Methodological to complete the definition, the meaning of the relationship of points and lines for example is to explore several theories, such as the following proposition:

**Proposition 1.** If \( S_h(t, l) \) is a hexagon shape, then the distance of 6 (six) points with the center point is the same as the hexagon side of \( l \).

In Proposition 1 there is a statement which abstraction in the methodology is proven. To prove that statement, the foundations of understanding build arguments that are in reality true. For example, for the sides facing \( S_h(t, l) \) there are two straight lines that connect the end points of the side to the other side with an angle of 90°. It directly shows that justification does not apply immediately if it is not from something true.

For example, stated equilateral triangle, along with the center point the distance is equal to 3 (three) vertices. Methodologically, it yields the following argument:

**Theorem 1.** \( S_h(t, l) \) is a hexagon shape if and only if it consist of 6 (six) equilateral triangles.

As a methodology, Proposition 1 contains compound statements in which the second statement supports or corroborates the first statement, but not vice versa. Therefore, only proof is needed for the necessary conditions. In contrast to that, Theorem 1 consists of two mutually supportive statements. Thus, to prove the truth of the compounded statement, it is necessary to have necessary and sufficient conditions, that is proof for the statement "if \( S_h(t, l) \) is
a hexagon form, then $S_h(t, l)$ consists of 6 (six) equilateral triangle." And proof of the statement" If $S_h(t, l)$ consists of 6 (six) equilateral triangle, 1 (one) hexagon shape is built up" Thus, if the area of the triangle is

$$L_3 = \frac{1}{2} a \times h$$

Where $a$ is the base of equilateral triangle (one side), and $h$ is the height of the triangle or

$$h = \sqrt{l^2 - \frac{1}{4}l^2} = \frac{\sqrt{3}}{2}l.$$  \hspace{1cm} (3)

So, the area of the equilateral triangle is

$$L_3 = \frac{1}{2} l \times \frac{\sqrt{3}}{2}l = \frac{\sqrt{3}}{4}l^2.$$ \hspace{1cm} (4)

Furthermore, the area of hexagon shape is obtained as follows

$$L_6 = 6L_3 = \frac{3\sqrt{3}}{2}l^2.$$ \hspace{1cm} (5)

The last equation proves that there is one lemma as follows:

**Lemma 1.** Let’s say $l$ is the side of an equilateral triangle. If $S_h(t, l)$ is a hexagon shape based on an equilateral triangle, then the area of $S_h(t, l)$ is $2\sqrt{3}l^2$.

Indirectly from the description of the two forms above: equilateral triangle and hexagon, can be conclude as follows.

**Corollary 1.** For the point $t = 3, 4, 5, \ldots, n$, there is the form $S(t, l)$ with the line $l = 3, 4, 5, \ldots, n$.

Methodology of a subject of study will produce a description and abstraction that presents a theory. Starting from the Definition, Proposition, Lemma, Theorem to Corollary. Every part of the theory has a method. It is the study of methodology as a method science. Although, it is special, it can rob all objects of study. Methodology, a way that is present for truth, but not justification for something that is wrong. The equilateral triangle with the concept of permutation operations of $1, 2, 3$ qualifies the group $S_1, S_2, S_3, S_4$ [38]. Because equilateral triangles form a hexagon, indirectly the hexagon with the concept of permutation operations of $1, 2, 3, 4, 5, 6$ also qualifies the group. Thus, the methodology is not only related to the truth, method, and purpose component, but also relates to the systematic $\sigma$ and the structure $\xi$. Or as a development of Eq. (1), i.e.

$$f(\tau, \pi, \gamma, \sigma, \xi) = \tau + \pi + \gamma + \sigma + \xi$$ \hspace{1cm} (6)

which states a methodology is a way to track systematically and in structure the existence of truth logically.

4. Conclusion

Methodology is not a science specifically studied, but it is a science of methods, ways of doing, or behaving like that method. In this methodology, not only are the ways and steps to resolve or obtain the truth, but how the truth is formulated in accordance with the flow of logic that forms the structure. In this case, the abstraction becomes the determinant of the truth that applies to all, even though it is specifically revealed. Assumptions, realities and evidence reinforce behavior in methodology starting from the definition, lemma, propositions, theorems, or etc.
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