

Purpose of learning mathematics: supreme knowledge

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Abstract: *Mathematics evidenced un/manifested in/active, un/changeable, im/pure and primordial nature; therefore, it is illimitable to define as finite. It exists in the engineering of this universe. Philosophy of Mathematics studies abstract entities such as assumption and implication. Mathematics educators regard it as deductive tool and relate to solving the real-world problems. They tend to understand mathematics as already formulated syntax awaiting to be applied when needed. Notwithstanding, this paper emphasizes the purpose of learning mathematics as Supreme knowledge. The paper explores the ideal model of acquiring Supreme knowledge through mathematical pedagogy. The context of this study is developing a three-layered systematic model (Language to Syntax, Syntax to operation, and Operation to Visualization) in Mathematics Education; the model has been termed as DIN Mathematical model of pedagogy. The first layer brings about an input of mathematical language to Syntax, the second layer is about syntax to operation, and the third layer is about operation to visualization. Educators engage in the second layer in most of the time to solve the problems where learner inputs on the formulated syntax and find one-way output. Engaging in the second layer does not assist to create higher level of cognitive state of learners. In this case, the learner can not achieve a complete visualization of process of Mathematics learning. Therefore, learners may not achieve Supreme Knowledge. The DIN model proposes that the three parts creating by mental acts in mathematics education which leads the learners to the way of the Supreme Knowledge of mathematics.*

Keywords: Consciousness level, Pedagogy, Supreme knowledge, Teaching-learning mathematics

INTRODUCTION

Teaching mathematics straight from textbooks covers the major culture of teaching methods-based in our academic institutions including University and Schools. Apparently, this practice prevails classical one. Mathematics educators appear to understand mathematics as a formulated capsule that can be swallowed with plain linguistic water in the academic institutions. Method-based teaching and learning activities have become a de facto culture in schools and university. Classical method-based learning bounds the learner's cognitive action because already existed formula is applied in the problem. In the interval of nearly three generations, teaching mathematics still takes this form. A learner cannot elevate her/his intellect to visualization and contemplation without through process of learning. As Mathematician and Applied Linguist, we realize we need to heighten novelty in mathematics education to avoid the such nature of limitation of method-based teaching.

My grand teachers, my teachers, and I, to some extent, are dealing with the similar questions, imposing the students repeat the same pattern of exercise, evaluating them based on the same textbooks and questions.

Ancestral educators evaluation system based the same questions from the textbooks. We learned the same pattern. At present, we repeat the similar structure to our students. Traditional way of teaching mathematics lead the students to confined result, but it entertainingly does not lead to supreme knowledge of mathematics. Teaching mathematics is cramming students' brain with contents. Contents reflect resemblance to atomicity of mathematics. Mathematical content alone can not quench learners' ability to learn more. We need to feed the process of mathematics education. "It still remains a challenge to deliver purposeful mathematics tasks in many classrooms" (Sparrow, 2008a as cited in Giardini, 2016, p. 13). Let us bring an example of teaching "Function" to our students. When teacher teaches "Function", she / he explains the domain and range. If variable x 's input can not return output, it no longer becomes inside domain. The problem may not be part of any specific person, institution or a country. We find enough literature documenting increment in failure rate at mathematics. The mathematics is taken as an irritating, anxiety-provoking and complex subject.



Figure: 1 Mathematical language and symbol

Imagine we need to find out the area and volume of the given model as shown in figure 1. Mathematically, this picture is mathematical language or symbols. This picture comes from an architecture lab room of Kathmandu University. How to calculate the area and volume of this picture? The learner needs to start with input on some kind of Function thought it looks complex. What is the language in the mind of learner starts with when the learners first observe the picture?

Majority of mathematics learners presuppose it as anxiety-provoking, complex and unappealing in daily life. Daily life mathematics limits to addition, subtraction, multiplication and division. Mathematics education comprises beyond daily usage; as we expressed in abstract, it exist in the engineering of universe. Therefore, it signifies linguistic context of mathematical expression.

Hence, mathematics educators and research scholars have a common problem in research mathematics. They were and are investing huge energy as well as a synergy to find out how mathematics can be made easy to learn and excel in it while relating it to the real-world situation.

In this regard, today's universities and schools are missing the target. Consequently, researchers and mathematics educator face a concerted issue. The solution of this issue resides inside methodical procedures. Educators have confounded to achieve the simplified solutions. Excellent achievement can be obtained by relating it to the real-world context. In this regard, worldwide constitutions overlook the point of reference. Instead of resorting huge amount of synergies, we need to become insightful to penetrate to the fathomable bottom.

To us, mathematics education consoles the deep down every day. However, mathematics educators have taken it as education that run only in teaching hours in the classroom. If we were not mathematical thinker, we would have ended in some other profession. Our perspective comes from lived reality of mathematics teaching. Many mathematics educators and philosophers who believe in acquisition of mathematical knowledge as supreme one, have been questioning to education systems of the world. What is the philosophy of mathematics? Who are mathematics students? What is the rationale behind mathematics education? What would the learner become after graduation of mathematics? These questions are complex to answer educator do not believe in philosophy of mathematics.

Authors of this article believe that formal education prevails as key component for purposeful teaching-learning process. Besides informal education from society and social media, there does not exist any other formal institution for teaching-learning activities. Formal education provides such as school and university play a vital role in learner's life. World leaders of mathematics education need to explore to penetrate to the capacity measure in order to improve mathematics education. This is where supreme knowledge of mathematics comes into play. To explore further, we would like to bring an example of hand calculating pedagogy in the early mathematics classes. Hand calculation represents mathematical language of early childhood. Abacus and bead can be taken another mathematical language to add the next. Mathematics language initiates the journey to supreme knowledge of mathematics.

SUPREME KNOWLEDGE AND ITS NATURE

Basically; truths, beliefs, and justifications are found in action. Body and mind engage together for action thereafter consciousness level takes place. And consciousness level gives birth to knowledge. And there is no end of understanding of things because today's justifications will be tomorrow's problem. Therefore, acquiring knowledge is a never-ending process and it depends on action. So, actions are the source of Supreme knowledge.

For a mathematics educator, teaching and learning actions are pedagogy. Pedagogy enhances the consciousness level then after that creates the visualization and it generates power to solve real-life or social problems. That is the supreme knowledge of mathematics, which is based on pedagogy. For this, the proposed DIN model of mathematical pedagogy structures as follows.

- Language to syntax – first layer
- Syntax to operation – second layer
- Operation to visualization – third layer

Supreme knowledge stays on the highest level in the hierarchy. It consists of three stages in the acquisition process. Visualization of the three stages layer assist to understand the phenomena. The authors declare that the supreme knowledge comes from visualization. However, visualization is discretionary by virtue linguistic characteristics. To interpret the visualization process, Saussurean dyadic model of linguistic sign (signifier – sound image and signified - concept) has been referenced (Habbib, 2016). Supreme knowledge does not demote the closing door for another knowledge. It rather opens a vast opportunity of mathematical knowledge because visualization happens to be arbitrary. Mathematical learner becomes free to select visualization process based on his/her social context and culture.

The ultimate destination of human imagination ends in action demanded by it. Beliefs, justification, truth finally are destined to become in human society. When the action manifests, the process impact vice versa. Mathematics learner, when they engage their mind and body for learning mathematics education, remains in the first layer of our proposal. There can be more methodical mathematical language to explain. However, for the discussion of this paper, we have chosen hand calculation method. Hand calculation method normally applied in lower level classes. The same concept can be applied using computer-assisted application in the higher classes.

We regard philosophical assumption as supreme knowledge in this paper. The ontological element of mathematics orients to the nature of reality. What is the universal reality of mathematics? The reality appears to be baffling: single/multiple un/manifested in/active, un/changeable, im/pure and primordial nature. The epistemic cognition seems to be both subjective and objective. Syntactic dealing with number happens to become objective. Semantic connection of numbers to mathematics seems primordial nobleness. Teaching learning should be carried out by subjective and objective way. How does a mathematics educator manage this supreme knowledge in classroom? In this way, mathematics teaching-learning practices require authentic actions in the classroom. Following procedural pedagogy nears to true academic excellence. This has become a demand of the 21st century. Journey of acquiring supreme knowledge in mathematics necessitate thinking, analyzing, reasoning and critical reflection. This can be achieved by two programming technique: one analogic programming, next digital programming. Thus conducted “pedagogy connects mathematics learners to the zone of consciousness where learner engages in “meta-discourse” (Hausberger, 2017).

Language to Syntax

Hand calculation has come long way from its beginning; hence, primordial. Hand calculation technique equals to analogical mathematical language. This opportunity provides a

child to utilize sensory organ to understand mathematics in early age. Calculating technique affords to utilize numbers into syntactic form. Completing first to an early learner can be challenging. However, the learner has already started its journey to primal cognition. At this stage of learning, the learner cannot yield for complete visualization because the ontological standpoint still poses to single reality due to syntactical limit. The same technique can be digitally program into computer for adult learners. The epistemic relation of teaching-learning to mathematics depends on what method the educator applies in the classroom.

Syntax to Operation

When a learner approaches into syntax level, the learner completes the first layer. Hand calculation represents an example. However, the learner is free to utilize mental calculation. In the second layer of program, the learner applies the syntax for further operation. Playing through the many operational exercises, the learner goes to next level. This layer can be extensive in nature. Multiple techniques of solving problem can be utilized. The epistemic approach of multiplicity creates image about the problem.

Operation to Visualization

What can a teacher do in this layer? Teacher's job is to facilitate the learner to visualize where such operation can be used in the society. In this case, the learner starts searching axiological interrogation. Based on visualization of total procedure and values, the learner either brackets his/her values on it or loads the value on it. Both ways are suitable for visualization. Finally, the based on the axiology, the learner visualize the method of application what she/he has till the date or what she/he can do. We believe that learners' emanation, infallible personality, believe, interest, the knower of the field, and qualification that imposes with a potentiality for creation is consciousness.

HAND-CALCULATING APPROACH AS MATHEMATICAL LANGUAGE

This section explores the students' experience towards nature on hand-calculating approach in learning school mathematics. The sample size was from five secondary level (grade 9 - 12) students of community schools in Kathmandu, Nepal. We asked open-ended questions to the participant about method and technique teacher used in the classroom. Out of 25 participants, 7 students responded that mathematics education means understanding the process of calculation. Those were taught using the Abacus, hand calculation and computer program used for teaching in 3 schools. 12 students answered that learning mathematics mean rotting by memory. Those

students were taught by using syntax and formula memorization. Teacher solved the problem on the white board. The learners copied the solution on the paper. They repeat the structure without understanding the problem and solutions. 6 students hesitated to respond the questions. Then we headed to see their mathematics teacher in the staff room.

The teachers responded in their behalf. According to the teachers, the student study just for passing the exam and promotion to next grade. The researchers also asked a question to their mathematics teachers on ‘how were they supporting their students for learning mathematics?’ teachers reflected that they were also doing considerable struggle such as they managed presentation, played a role model, collaborated for activity, and allowed time to solve the problem in the classroom. But the result showed opposite as learners engaged in the process only, rote-memorizing formula forgot soon. We raised few literal questions here. What is the purpose of teaching and learning mathematics in this way? Where is the link for mathematics education to relate outside world? Does such practice enhance in logical skills among learners? Where is the space for them to analyze, critical thinking? Indeed, mathematics education is all about problem solving, analyzing, critical thinking, simulation, and maybe many more. The holistic approach means more than the sum of its parts.

PROPOSED PEDAGOGICAL MODEL

The initial stage of this model explains first layers of pedagogical teaching. In the first layer of our model, learners have beginning understanding of mathematics. In this model, learners enter into the learning mathematics process. The International Congress on Mathematical Education concludes that the “philosophy of mathematics has always been of central importance in philosophy of mathematics education” (Ernest, Skovsmose, Bendegem, Bicudo, Kvasz, & Moeller, 2016). As shown in figure 2, Keeping the central phenomenon of this issue, this paper tries to open the new avenue for granting the Supreme knowledge of mathematics through programming in mathematics education as pedagogy.

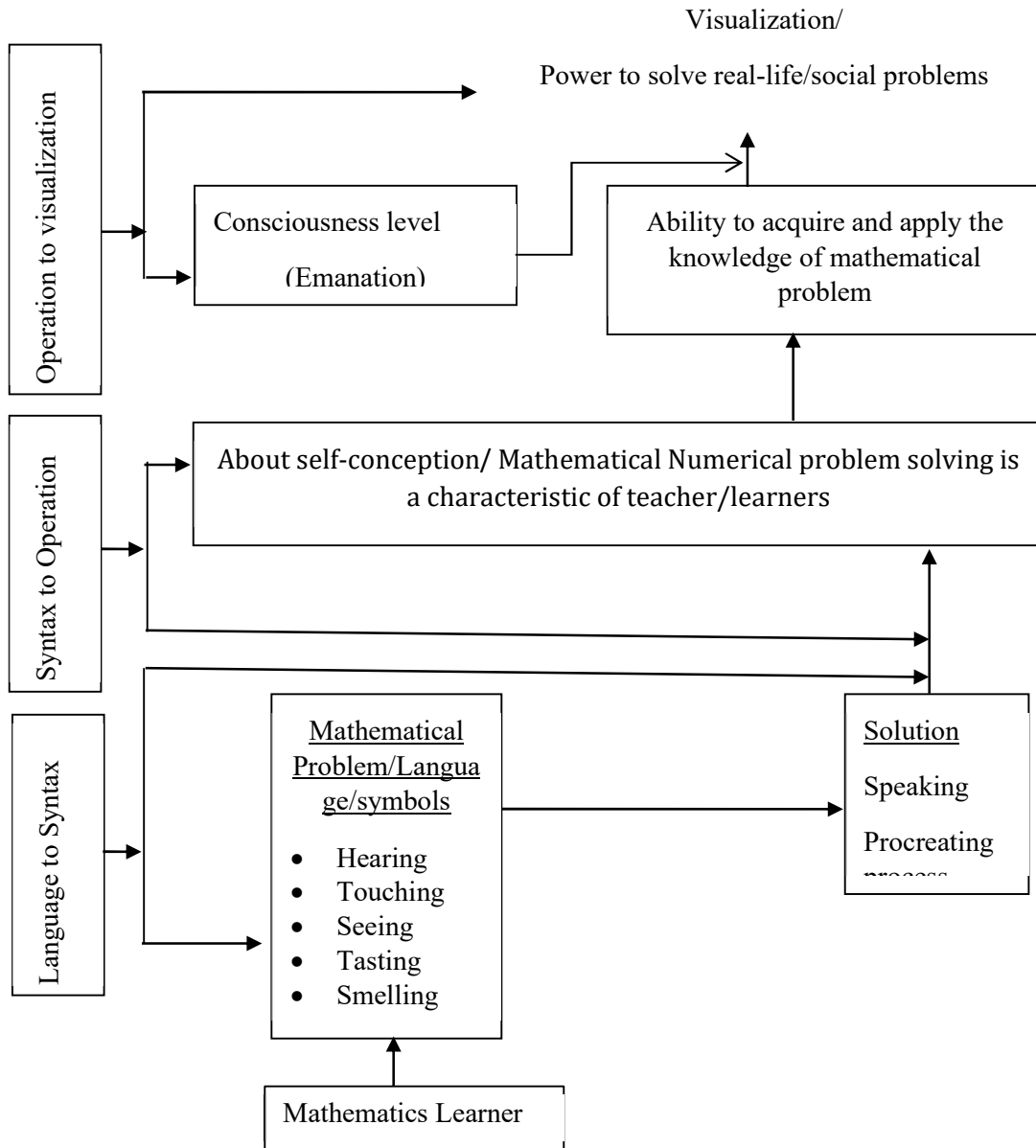


Figure 2: Ideal Model for Supreme knowledge

Figure 2 explains that, given the mathematical structure $2+2 = 4$ (language to syntax) remind the learner the fundamental equation behind it. The solution may construct the world beautifully or destroy the world unattractively. It may build a good social system or destruct. Who knows what is to be done with the equation or mathematical structure? Let us still keep secret the answer of this equation. Mathematics education can teach such equation by highly sophisticated computer programming way or hand calculating way. Having taught this way, we teach how to

manufacture the musical instrument like flute (syntax to operation). Let us make every thing open now: it is the consciousness of the mathematics learner that decides to create or destroy the world of societies or just to blow the pipe or to produce a melodious music. Mathematical number has dormant cosmic energy invisible. However, it looks for potential consciousness on to the learner (operation to visualization).

Engaging with mathematical structure is the deep relation between the parts of constituent qualities of living being and part of essence qualities imposes within the activities is in a social context (Dhakal, 2016). Thus, this model advocates that mathematics learners always start to learn mathematics from language to syntax.

On the basis of our bitter teaching and learning experiences, we have found mathematics a dead subject for learners, however, the importance of mathematics remains eternal. Hence, this study tries to make mathematics alive subject through its application in real life situation. And for this, mathematics teachers and learners should increase their consciousness level to perceive mathematics by blending it with computer. To make connection of mathematics learning with the world reality digital tools may play significant role as Bicudo (2016) states, “virtual reality support for the world reality”. Du Boulay (1980) states, “Computer programming used by students to model mathematical ideas”. In this computer and smart digital tools age computer courses are also included in school curricula.

Students learn to program and coding in computer to some extent in school’s education. Mathematics education researchers are looking for the better way of students’ engagement in digital tools, which support to visualize the things and “visualization enhance to analyze, exemplify and reflect” (Arcavi, 2003). Kristiansand (2017) states, “Digital learning technology helps Learner retain new concepts”. Beside these arguments, it also empowers learning from visual learning modality. Many studies were done regarding this issue. But the crux part of their studies poses a difficult question, “How to build the tools so that they are usable by both teachers and students?” (Mannila, 2009).

If mathematics education researchers neglect this issue, teaching mathematics with digital tools and software will become more complex. It is believed that mathematics itself is complex subject and if the intricacies of computers are added to it then what attitude may learner develop. Thus, while developing mathematical software or any mathematical digital tool for teaching and learning purpose it should be significantly scrutinized for users’ friendly.

Therefore, the context of this study is developing three-layer programming in mathematics education. The first layer is about input language to Syntax, second layer is about syntax to operation, and third layer is about operation to visualization. Mathematical learners engage in to the first layer. They input the mathematical language and computer convert it into syntax. Syntax makes the process of operation the mathematical language and provides the final model as output. Form that point, learners start to logically and critically thinking on input.

Conclusion

The notion of *Mathesis Universalis* offers the state of conceptual thinking by mathematics education (Ludwig Von Bertalanffy, 1972). Mathematics education does not limit only to number and deductive reasoning. Mathematics relate to the state, thinking, feeling, behaving, knowing what is happening around us, the fact of noticing the existence of mathematics, and also intend to know the inner characters of mathematics. In order to now mathematics is first thing and learning mathematics through programming in mathematics education is second step to increase consciousness level. When ontological, epistemic relation to the real world cognition is achieved, process of visualization begins to relate to the outer world. Consciousness level could be regenerated through knowing mathematics again and finally, learners lead in to the way of supreme knowledge. Leading into the way of supreme knowledge of mathematics is the purpose of learning mathematics.

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