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# A Comparative Study on Learning Styles and Strategies of High and Low Performing Students on Mathematics

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### Keywords

*High/Low performing, styles and Strategies, prolong engagement, meaningful teaching, learning environment*

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### Abstract

*The students in a class are diverged from many perspectives, among such perspectives their learning styles and strategies is one of the major. Basically, we as a teacher rather used to notice the learning styles and strategies of our students, we just motivated to categorize our students as high performer or low performer. In this context, this is a case study research on the topic 'A comparative study on learning styles and strategies of high and low performing students on mathematics' with the objectives to compare the learning strategies used by high and low performing students in mathematics. For which, four (two from each categories) students were selected purposively on the basis of their performance in mathematics as the key research participants from a higher secondary level. The identification of their learning strategies are based on four subheadings as readiness for learning, pre-knowledge of the content, process for learning and solving a problem. With the prolong engagement with participants, the study concluded with the various differences as well as similarities in each category and on the basis of such differences and similarities, the study further emphasized to be aware about their learning styles and strategies is more beneficial to create the meaningful teaching learning environment in the classroom.*

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## Introduction

No doubt, a classroom is the combination of various diversities among students because students come from different cultural and social background so they might have their own cultural value and capitals which continuously affecting them in many ways. Among various diverging variables, their way of learning and understanding of the particular content is one of the leading factors. Why of learning among students may vary one to another. My experiences as a mathematics educator as well as a manager of educational institutions show that the preferred learning styles and strategies of secondary school students are not considered well in managing teaching and learning of mathematics in class. There are several studies undertaken in different parts of the world say that a perfect match is necessary to make students' learning effective. Dunn (1995) study claimed that the mismatch between the teaching styles of teachers and the learning styles of students leads to frustration and lack of continued educational development. Similarly, Cano (2005) mentioned, students need to use their preferred learning styles and strategies to learn mathematics in a meaningful way (Cano, 2005:215). So, it is necessary to know that what a particular group of the students used to follow which styles and strategies in generating the solution or the understanding of mathematical problems for the betterment of teaching learning process for a teacher. This article throws light on the how high and low performing students utilizes their learning styles and strategies in learning of mathematics based on a comparative study in the use of learning styles and strategies in learning mathematics by the students.

We have a commonly accepted adage 'all individual are different' so that every students might have their own ways and

strategies of learning of a particular content of mathematics. We as a mathematics teacher, never try to know the learning styles or the strategy of the particular student which actually leads us (as well as our students) in the way of unsuccessfulness in the journey of our teaching. No doubt, it refers very high degree of success in this journey if the way of teaching (delivering) and way of learning matches with each other. Therefore, to know the learning styles and strategies of a particular group of students itself a big problem as well as knowing this is a key to success in mathematics. So I am here planning to compare the learning styles and strategies of high and low performing students in mathematics so that this may support one to another for the better understanding of mathematical content.

## Research Questions

The study was intended to get the answer of the following research questions:

- What styles and strategies are used by high performing and low performing students in mathematics learning ?
- In what ways do the styles and strategies in learning mathematics followed by high and low performing students differ ?

## Literature Review

Styles, normally perceived as the way one acts to receive information and reacts to that information. Zhang (2001) stated that style is not the ability it is rather one's preferred way of using his/her ability. So we can say that style is more than ability with the uniqueness in performing a certain action. Studies by Orlich *et al.* (2001) indicated that students with different learning styles understand problems in different ways as suggested by Orlich, it is necessary to identify the learning strategies of the particular group of the students to

bring them in the mainstream of the learning. Additionally, Mathews (1996) argued that a person's learning styles develops because of hereditary factors, life experiences, and the demand of the present environment. Oxford and Green (1996) explore the differences between the learning strategies and learning styles as learning strategies as specific behaviors that learners use to improve their own learning while learning styles are the broad approaches to learning a new subject or solve a problem. This definition suggests us to take certain strategies come under the certain learning styles.

As Cangelosi (1996) states mathematics learning strategies are specific techniques used to promote and enhance mathematics learning. According to Wolters (1999), there are six cognitive and meta-cognitive learning strategies and these are rehearsal, elaboration, organization, planning, monitoring and regulation and these learning strategies are fundamental base point to identify the learning strategies of our students.

Adams (2000) conducted a study entitled "Research on learning styles in mathematics", with the objective of knowing the different styles of learning mathematics by the students and concluded with three different major styles in mathematics classroom as visual, auditory and kinesthetic. Many children begin to struggle with mathematics at a young age. Math teachers often use a traditional curriculum that includes memorization of basic math facts and a standard method of solving problems. This approach does not recognize difference in learning styles among students which quite necessary for the better teaching learning process.

A group of mathematics (1995) had conducted a research on the topic "Learning styles in

mathematics classroom" with the objectives to find out the learning styles in mathematics classroom. The data was collected by the mathematics attitude questionnaire and set of parallel mathematics achievement tests. Field notes were collected from the regular observation of the class and discussion between the researcher and students, teacher and parents. The study finally concluded with two major way of knowing as separated knowing and connected knowing. But, study unable to compare the which group of the students are more intended to which kinds of knowing as they mentioned connected and separated.

Chan (2001) also investigated the learning styles of 398 gifted and non-gifted Hong-Kong Chinese secondary school students using the Chinese version of the Learning Styles Inventory (LSI). This instrument helped to assess students' preferences for nine teaching modes including discussion, drill and recitation, independent-study, lecture, peer-teaching, programmed-instruction, projects, simulation and teaching-games. Chan included the dimensions of preferred learning activities common for gifted and non-gifted students to be factors interpretable as learning through verbal interaction, learning by role playing, and learning by doing. In this study, gifted students indicated significantly greater preference for learning styles related to interpersonal verbal exchange and autonomous learning. Although there were no significant gender differences in learning styles preferences, the younger age group indicated significantly greater preference for learning styles related to structured activities and games than the older age group. Moreover, the study revealed that both gifted and non-gifted students prefer learning styles that are related to verbal interaction between teachers and students and among students. Gifted and non-gifted students share a

similar dislike of teacher-directed structured activities involving drilling and recitation.

Research and professor of Harvard University, Howard, G. (1983) has proposed a new and wider view of the term intelligence among students in his book 'Frame of mind', called the 'Theory of multiple intelligence' which challenged the dominant definition of intelligence as limited to mathematical and linguistic abilities (verbal and computational intelligences). Gardner theorized that rather than just these two intelligences, a grouping of seven intelligences more accurately accounts for the diversity of ways in which people acquire and utilize knowledge. Professor Harvard has used the term 'intelligence' as the capacity to solve the problems.

Gardner's seven intelligences are :

- Logical-Mathematical Intelligence- the ability to detect patterns, reason deductively and think logically. Most often associated with scientific and mathematical thinking.
- Linguistic Intelligence- the ability to use language masterfully to express oneself rhetorically or poetically. Also allows one to use language as a means to remember information.
- Spatial Intelligence - the ability to manipulate and create mental images in order to solve problems. Not limited to visual sight, Gardner noted that blind children possess spatial intelligence.
- Musical Intelligence - the ability to read, understand, and compose musical pitches, tones and rhythms. (Auditory functions are required for a person to develop this intelligence in relation to pitch and tone, but it is not needed for the knowledge of rhythm)

- Bodily-Kinesthetic Intelligence- the ability to use one's mind to control one's bodily movements. This challenges the popular belief that mental and physical activities are unrelated.
- Interpersonal Intelligence- the ability to apprehend the feelings and intentions of others.
- Intrapersonal Intelligence- the ability to understand one's own feelings and motivations.

The 'theory of multiple intelligence' will help me to know different types of the intelligence among students as well as the way of knowing the same content differently. Certain types of intelligence may itself bring some certain types of learning styles and strategies so it may support me to know the best adapted way of learning by the students of certain categories.

I also used certain aspect of constructivism and behaviorist learning theory as well in the process of knowing the way of teaching adapted by the teacher as well as the way of learning adapted by the students to analyze the results in this paper.

### **Methodology**

The study is conducted within the framework of case study research design. I had been teaching the same group of students (grade 12) from last 3 years so was quite familiar about their attitude and performances relating with mathematics. By using my personal experience and the history of their academic performance mainly through their scores in different tests, I selected 4 students as my key respondents using purposive sampling technique. Out of these four, two were high performing and two were low performing studying in higher secondary school of Kathmandu valley. A prolong

engagement and persistent observation with my research participants, I tried to reach on conclusions about their learning strategies. While generating my data, I never let them to know that I have doing some experiment on them. Even I kept my emphasis on my research participants while teaching, I was continuously be ware about the involvement of every students in the teaching learning process.

After selecting two students from each category, I regularly observed them for 25 days to know about their learning strategies and other behaviors including physical and psychological activities. And at the end stage observation period. I took an informal interview with them to know about their intrinsic facts about their way of knowing which cannot be seen from the observation. The main area that I used to observe my key respondents are as readiness for learning, entering to the lessons, learning a new concept, strategies for learning and solving a new problem with the objectives to compare. Even though these two formal ways of generating data have used in the study, I have used my experiences of teaching, and learning in the narrative way also as the key source of the data.

I have interpreted the data within the frame work of interpretive research paradigm by comparing different behaviors of the students in learning the certain content of mathematics between the categories (high and low performing) of the students. In the process of analysis, first I listed all the behaviors of the students in each section and then I separate them with the similar behaviors and search a pattern or the nature of the students and bring out some findings.

## **Findings and Discussion**

I as intended to know the general practice in the way of learning mathematics by the groups of high and low performing students. It was quite difficult to label a student as high and low performing if we go out of the score in exam obtained by the students. Even though it was not so effective idea to categories the students in term of marks achieved in exam, this can somehow reflects the overall idea of the students how much content he/she understood.

Generally the learning strategies bring some special characteristics of the students about his/her general practice of learning mathematics. I think 'what strategy is being used ?' by students also reflects the fact that 'how much fundamental things that he/she has learned in mathematics ?' No doubt, each student might have their unique way of perceiving a new knowledge and making a schema about the concepts which can also help them to be unique in the group. The comparative analysis of their learning strategies is done in the following passage under the pre-mentioned sub headings.

### ***Reading for learning***

Readiness is the most essential pre-requisite for the meaningful learning (Bottoms, 2003). So I first suppose it is necessary to compare their (high and low performing) readiness for learning. We can suppose it as the first indicators of success in the process of learning. In my journey of teaching and learning and also from the experience of field, I acknowledged that most of the high performing students are seem to have a good willingness and readiness (Wigfield & Eccles, 2000) for learning. They used to be optimistic from their teachers. Normally, they seem to be hungered and hurried to learn. In most of the days, they used to open their

book, homework, confusing questions etc. before to enter me in the class which shows their readiness or the wiling for the learning. And generally, also they used to have positive attitude towards their own learning and they used to have the feeling of that 'I can learn' as viewed by Shah (2007).

Unless and until we are unable to prepare (mentally as well as physically) our students, we cannot teach meaningfully to our students so this might be the first step for the better understanding. Most of the low performing students seem to have less readiness as well as willingness for the learning. Generally, they used to have pessimistic thought about their own learning of mathematics. In most of the days, they used to come in the class with their puzzled minds (Ford, and Chen, 2001) about 'what to do ?' and 'what not to do ?' They used to have moderate attitude towards their learning capacity of mathematics. But a small seed of possibilities is still alive there that if we (teachers) tried to know their actual problems in their journey of learning and then by treating them in the way as they required, they can learn better. You need to include data/information. Write students views and your experiences in their own language/natural setting. Where is your comparison?

#### ***Pre-concepts of the content***

In most of the content of mathematics more or less it is connected with some pre basic concepts. To have the better understanding on a particular content of the mathematics, it is necessary to have some pre-concepts (Donovan & Bransford, 2005). On the basis of my experiences with my research participants, most of the high performing students used to have comparatively more pre concepts usually obtained by rote memorizing as viewed by (Mayer, 1999). They have the ability to memorize even of the abstract

content without caring the conceptual and the practical understanding.

The group of low performing students usually found having comparatively less pre concepts in most of the content of mathematics. If we (teachers) inter into the content directly without reviewing the required pre-requisite or pre-concepts, I found they can learn nothing further. But usually what the concepts do they have is not based on rote memorization normally based on examples (PISSA, 2010) so that, the use of appropriate examples or the visual representation may play a great role in promoting their learning and to make the learning for long.

#### ***Learning a new concepts***

In this sub-heading, I am trying to explore about how a high performing and low performing students generally used to make a schema of new mathematical contents. Normally, the group of high performing students can make an image of new concepts only by the oral definitions in comparison with the group of low performing students. They can see the connection of new idea with pre concepts just by the words (definitions). Generally, they used to memorize the definitions and go in examples so that they used to learn a new concept in deductive nature. And, they used to be satisfied just by memorizing, even though they do not have an actual image of the concepts. Generally, they used to follow a complete pattern in solving a problem in mathematics. And one noticeable habit with them is that, even if they do not understand completely they become ready to do as viewed by (Hudson & Miller, 2006). Through my experiences, there are some negative thought with such high performing students like do not care about sharing with friends and they never be ready to ask with friends even if they do not understand

because normally they used to have a kind of proud or the overconfident about their own learning which might be one the obstacle for better understanding.

But in the next hand, the group of low performing students normally starts to make a schema about the certain content with the help examples and they used to understand the definition on the basis these examples so that generally they seem to fallow the inductive nature while learning a new concepts (Chan and Winter, 2001). Obviously, they have less ability to make a concept about the abstract content, so however possible they used to expect visual representation or the materials for the better understanding of the examples and pictures. As our theoretical framework support, normally they used to seek the pattern or a kind of rhythm in solving a problem so that they can follow the same process what they followed in previous. And hence, the best way to make them success in the learning process is to make engaged in the class and by connecting the contents with examples. The groups of low performing students rather interested to rote memorize. In most of the days, they used to be very less participation in the class. They never seem to be interested to do themselves a problem while they do not understand. But they seem to be more interested to do themselves if they understand. Generally, they expect more help from the teachers as well from their friends so they seem to be a dependent learner as view by Kirschner (2006). And they usually used to ask the questions first with their friends because they used to have the feeling of being shy in the class by asking the questions with the teacher in a loud sound.

### ***Solving a problem***

While in the process of solving the problems in mathematics, I got that normally the group

of high performing students enters to the problems by focusing on 'what the questions tells to do ?' Then only they used to focus 'what the question is given to them ?' Means that first they used to observe the destination and then only they see the foundation part of the questions. Generally, while they are solving a problem they rarely go back (turning the previous pages of copy) even though they have confusion, they directly motivated to ask with the teacher without trying to thinking on that. But in his journey of the teaching and learning, I never have seen that a high performing student asks with the low performing student asks with the low performing students have understood the matter in which he/she is getting confusion, the finding more or less matched with the finding of Olson et al. (2009). One thing more I got from this study is that, a high performing students never be ready to terminate the process of solving a problem without getting the answer of the question which might be a key indicator of his/her success.

While in the process of solving the problems in mathematics, the group of low performing students usually keep their attention on 'what are given ?' in the question while solving a problem in mathematics then only observe 'what the questions tells to do ?' In solving the problems in mathematics they try to follow completely the same process what they followed in previous example so that they used to turn back the pages of their copy frequently in solving a problem. They usually heisted to ask the question with the teachers but they feel easy to ask the questions with their peers. And a awful habits with such low performing students that they always be ready to leave the process of solving a problem without getting the answer and they easily ready to accept that 'I cannot do this' so better to leave but they never try to investigate further to that problem as viewed by (Manner, 2001).

## Conclusion

The study will help to know the area that has to be focused while teaching a particular content for a teacher to create an active engagement of the students in the process of learning. In the same way, this study will help me (possibly others) to develop my professional teaching carrier because I hope I can do better only when I know about their (my students) way of knowing. This study will be significant from the policy level for an educator as well because the policy maker can get some insight about the different styles and strategies of high and low performing students so that they can prefer certain types of teaching learning strategies according as the need of the targeted students.

From the overall analysis of the above mentioned text, it is conclude that the groups of high and low achieving students are significantly different with respect to their learning strategies on mathematics. So we as a mathematics teacher have to know the particular styles and strategies followed by the particular group of the students while acquiring a new mathematical concepts so that we can led every students in the mainstream of the learning with the active involvement in the teaching learning process.

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