Chapter I

INTRODUCTION

Background of the Study

Since human civilization, mathematics has been a basic hierarchy for the human day to day life. Mathematics was created to fulfill our basic human needs. Along with the revolution of a society, mathematics also has changed a lot in terms of its application, nature and discipline and became a field of study. Mathematics is derived from the ancient Greek word “Manthanician” which means “to learn”. History shows that mathematics was developed to solve day to day problems. Later on advanced form of mathematics structure, rules, formulas, theories have been developed and used on solving problems through empirical observation and experiences. Nowadays human discipline is interpreted in mathematical models. As a result, mathematics is a key to every single field of study. It is one of the important subjects in school education which provides a platform for the development of entire mathematics education as well as foundation for higher studies in the field of science, management and so on.

On the other side, there is always a question that when are we ever going to use mathematics? This plaintive question from frustrated mathematics students is heard in schools around our country as they wrestle with pages of abstract mathematics and learn algorithms that appear to go nowhere. They study real numbers, but don’t find any reason to believe that they are real. Thousands of American students still work from textbooks that limit applications to age problems and mixtures of nuts. Despite the call from the National Council of Teachers of Mathematics in the Principles and Standards for School Mathematics (2000) for meaningful learning through study of realistic applications, many students will find that the only modernization of content over their

grandparents' math books is that jet planes have replaced the trains that used to travel at different rates between cities.

The twentieth century saw an explosion of applications of mathematics. It is now hard to find a field of study that does not use mathematical tools. Biologists use differential equations. Chemists use solid geometry to describe molecules. Set designers in theaters use trigonometry to determine the best lighting for a play. Historians determine authorship of obscure documents through statistical analysis of words. Governments, international corporations, and individual in- vestors use mathematical rules to determine production, employment, and prices. Everybody uses computers. Unfortunately, even good students don't know how mathematics affects their lives. Few understand the power of compound interest. Few realize that the compound interest embedded in credit cards can bring adults to bankruptcy. Few know the mathematical implications of public policies that will affect their lives. Even fewer know how to make the best decisions based on the probabilities of risk rather than blind gambles.

In underdeveloped nations such as Nepal education is an important aspect of country development. Education status shows how developed a country is. Without effective education systems, a country can't move forward on the path of development. A good education has the power to change the world as it can produce required manpower for the nation. As a matter of fact, good education systems can be seen as strong pillars for solid nations. In the context of Nepal, the majority of people can't afford a good quality of education unless they are from a wealthy family. The government does not budget enough money to provide a good education even though it is one of the most important components for developing a country. The lack of attention to our education systems has impacted the study of subjects like mathematics

and science. These subjects require a practical teaching approach. Without necessary teaching materials and teacher training, the study of mathematics and science is challenging. Students are not able to acquire solid mathematical concepts, and teachers are unsure how to motivate students within the classroom. In the context of Nepal, still a big portion of the population are deprived of basic education as they are living in rural areas of the nation and also the government is unable to make education accessible to all. As the government is not reaching out to these rural areas, students are not even getting text books, so you can imagine how poor the education system is. However, in the city areas some students are able to get better education quality but still lacking of required teaching materials and teacher training, the effective teaching has not been taking place in the classroom. Absence of good quality education in school level has affected teaching procedure in the classroom, students' performance on mathematics and understanding simple mathematics concepts. As a result, students get frustrated and discouraged. Because of the anxiety, students are not willing to take mathematics as a major subject in higher education. Meanwhile, students prefer to pursue their career in the field of Management, Humanities etc as they are easier, have better opportunities for jobs.

While STEM subjects such as science, technology, engineering, and math are encouraged in Nepal and emphasized among grade level students (www.stemnepal.org/about), few students select math for further studies (Joshi 2017). Mathematics is one such discipline essential to human's day to day life, the cradle of all creation without which the world cannot move.

Joshi (2017) found that the growing numbers of students abandoned science and mathematics at both school and college levels of late. Rapid decline in the learning habit among students indicates that there is something missing in the existing teaching-

learning process," he said, "The alarming factors in Nepali context are: failure to connect the science and math lessons with the real society, fixed but negative mindset of the parents and their kids towards the output of the subjects, lack of intervention of the policy makers and educationists and mismanagement of the science and math products among others".

Lantz Alma E, Smith Gregory P (1981) found that students are willing to choose other subjects over the mathematics in higher study; the major factor they discovered was lack of confidence in the subject. The researchers concluded that students are afraid of taking it as a major and not able to do well in the test because students have perception that mathematics is the most difficult subject. Jerry Trusty (2011) concluded that there is another factor responsible for students' decision to not choose mathematics to pursue at the college level. If students' performance is not good in high school then they are more likely to choose non-required subjects. Overall, there are many factors which play a vital role in students' decision making whether they want to pursue their higher studies in mathematics or not. This research is going to help mathematicians, curriculum makers and teachers to change the perspective and make improvement in the field of mathematics.

To find the possible result, I am going to use qualitative research. I will choose some of the schools from the town and get enough responses from the students through "in-depth interviews". The research will include some of the questions like "what do you think are the factors that influence students' decisions to take mathematics as a major in their higher studies?"

Statements of the Problem

Interest in taking Mathematics as a major in college level has decreased. Adam V. Maltese and Hamilton (2008), Did study common enrollment patterns taking STEM

in college now and researched students' achievement in STEM the past 40 years. Research indicated that the number of bachelor's degrees has nearly tripled whereas, the number has declined and reached below previous level. The survey found that there is a big difference in the number of students enrolling in mathematics subjects and shows a decreasing trend on numbers of students' interested taking mathematics as a major in higher study. Education Management Information System: Report on higher education (2010/2011) collected data shows that the number of students enrolling in STEM fields. For example, in engineering it is standing just below 20,000 which is really low compared to the fields like management and education standing just below 160,000 and just over 120,000 respectively.

The entire education quality in Nepal has not improved much which has a direct impact on mathematics education. Having a poor education quality and policy do not seem to contribute to having a practical teaching approach in the field of mathematics. In fact, students are not finding it interesting and an easy subject. In addition, there are a lot of formulas, axioms and postulates to memorize which most of the students do not want to be bothered. Most of the contents in secondary school mathematics directly deal with human day to day life problems. However, due to poor teaching systems students are not able to make interrelation between those problems with mathematics. As I mentioned earlier, there are lots of factors that have been influencing students' decisions. Factors that have played a vital role to make people uninterested towards mathematics need to be discovered.

Objective of the Study

The purpose of this study is to

> Investigate and identify the possible factors that influence students' decision to select mathematics in higher studies.

Research Questions

The researcher formulated the following questions to serve as a guide for the research.

1. How do you decide what you are going to study further?
2. How do you describe the mathematics experience over the other subjects?
3. What are the problems you face while learning and teaching mathematics in the classroom?

Signification of the Study

The outcome of the study will be helpful to students, teachers, curriculum and policy makers and parents. It will help curriculum makers to understand the current mathematics education status and make them think about what needs to be changed and help them to build a strong and effective curriculum. The outcome will enable teachers to make an improvement the whole teaching procedure like using appropriate teaching materials and teaching approach which will play a vital role to motivate and engage students towards mathematics. If necessary teaching strategy can be applied in the classroom, students will be able to get more confidence and achieve good scores in mathematics. As a result, it will help to increase the number of students enrolling in higher studies taking mathematics as a major subject.

Delimitation of the Study

The study had the following limitations:

1. This study was limited to five secondary level schools in the Kaski district.
2. It was limited to secondary level schools of Pokhara valley.
3. This study was based on secondary level mathematics.
4. Three public and two private secondary schools were selected for the study.
5. The data of this study was collected through one-on-one interviews with students and teachers.

Chapter II

LITERATURE REVIEW

Review of Related Literature

Previous studies have identified many factors influencing students' decisions to declare mathematics as a major in higher study. However, in the context of underdeveloped countries like Nepal, little data exists.

To find the gap between the research that has been done already and the research that are going to be conducted in the future, the researcher tried to study every single research, journal, books and articles out there and analyzed them. To start with, Lantz Alma E, Smith Gregory P (1981) conducted a survey to find the factors that influence students' decision to select mathematics in higher study. The researchers targeted 1418 high school students for their survey and found that encouragement from significant others and subjective value placed on mathematics and subjective value placed on mathematics was the main predictor of taking non-required mathematics in both sexes. The study also compared students who intended to enroll in optional mathematics and later did so and students who intended to enroll in optional mathematics but did not and showed that students who acted inconsistently with their intention had less confidence in their mathematics ability. Moreover, the factors that initially influence students' decision choosing mathematics were found to be similar to factors influencing their decision later. But there are more factors to be discovered, so, Brown, Peter Brown and Tamara Bibby (2008) generated a survey with 1500 students from 17 different schools in England. The survey was based on free responses and closed items in a questionnaire. The survey was analyzed and found that lack of confidence in mathematics occurred as the main factor behind student not continuing mathematics. In

addition, dislike, boredom and lack of relevance are also factors. In fact, enjoyment is the key factor differentiating high and low participation indices. On the top of 'lack of confidence' as the main factor, another researcher Mahesh Raj Joshi (2017) added lack of trained teachers, and mathematics anxiety to the list. The study was based on students' attitude towards mathematics and the survey was conducted quantitative data and interviews with students and qualitative data for teachers. The survey covered 230 students from 12 community based schools and 40 statements of a questionnaire were used in the interviews. The collected data was organized, tabulated, analyzed and interpreted by using statistical packages for social science (SPSS). The study showed a positive attitude from the students towards mathematics. However, students are facing so many problems such as lack of confidence, mathematical anxiety etc.

Meece, J, L., Wigfield, A., and Eccles, J. S. (1990) conducted a survey and it was taken with 250 students of 7th-grade through 9th-grade. Analysis of collected data examined the relative influence of these performance, self perception and affect variables on students' subsequent grades and course enrollment intention in mathematics. The study resulted in math anxiety is the most directly related to students' math ability perceptions, performance expectancies and value perception. Students' performance expectations predicted the students' subsequent grades and value of perception affected the enrollment intentions. Merjorie Hennigsen and Mary Kay Stein (1997) focused on how classroom-based factors shape student engagement with mathematical tasks and pointed out that classroom environment is an important factor that encourages high-level mathematical thinking and reasoning. In order to develop students' capacity to do mathematics, classrooms must become environment students able to engage actively in rich, worthwhile mathematics activity.

Fennema and Sherman (1978) surveyed 1,320 students from Grade 6 to Grade 8 to compare verbal ability and spatial visualization and eight effective variables. No sex-related differences over all schools were found for any cognitive variables. When compared with their male peers, females were less confident of themselves in mathematics and males stereotyped at high school level. The research was conducted in both high school and middle school areas and found the significance difference between male and female achievement. Jerry Trusty (2011) also presented that making decisions on choosing mathematics and science as a major subject in higher level of education depends on students' performance in grade 8. Moreover, Gail Hackett and Nancy E Betz (1989) investigated the relationship between mathematical performance and mathematics self-efficacy collecting the data from 153 college women and 109 men and found that there is significant correlation with attitudes toward mathematics. Beside that regression analysis supported the superiority of mathematics self-efficacy over mathematics performance and achievement variables in predicting the choice of mathematics related major Predictors of math anxiety and influence on young adolescents' course enrollment intention and performance in mathematics. James Middleton (1999) conducted research in the area of motivation in mathematics, concluding that contextual factors and cognitive processes affect students' and teachers' motivation. On the other hand, the research also located that lack of theoretical guidance driving the conduct and interpretation of the majority of studies in the field. Mltese and Hamilton (2008) studies common enrollment patterns among students enrolled in STEM college's courses and researched students' achievement in STEM the past 40 years. The researchers discovered that the number of bachelor's degrees awarded has nearly tripled over the past 40 years whereas, the number has declined and reached below, previous level. For the survey, the sample was taken from

approximately 4700 high school and college students and found that the classroom experience in high school science and mathematics determine whether they want to complete their studies in major STEM.

Xueli Wang (2013) found that there are actually five different factors which influence students' decision taking STEM majors.1) Heterogeneous: research found that, majority of students taking STEM as a major are White 2) Intention: high school students' intention is also one of the factor 3) High school achievement: the achievement students get in high school actually influences on their decision for the higher study 4) initial postsecondary experience: the experience students have in postsecondary school directly affect students' decision 5) academic interaction and financial aid: definitely studying STEM in higher study is expensive compared to other subjects so, it also affects students' long term goal. Panthi, R.K; Belbase, S (2017) discussed the major issues of mathematics teaching and learning in Nepal and found that the teachers are not well trained and there are lack of teaching aids, materials and technological tools. In addition, social aspects such as gender issues, language issues, social justice issues and cultural issues like diversity of language and ethnicity also played an important role affecting the whole teaching procedure. The researcher suggested that improving the curriculum, teacher training, resourcing the classroom with locally made materials and necessary technological tools could be the key solution to the stated issues. Bed Raj Acharya (2017) conducted research on finding factors that affect difficulties in mathematics learning by learners and discovered that teachers and parents have to play an important role as a key and provider of a good environment and help learners to do better in the test. Moreover, unable to make relationships between new mathematics concepts and previously learned mathematics structure, mathematics anxiety, negative feeling to mathematics, school management system, lack of

infrastructure of school and regular assessment system are the main causes affecting mathematics learning. Elizabeth A. Gunderson, Gerardo Ramirez, Susan C. Levine and Sian L. Beilock (2011) did research on the role of parents and teachers in the development of gender related math attitude. The research explains that the girls tend to have a more negative attitude towards mathematics including gender stereotypes and self-concept compared to boys. In addition, parents and teachers expectancies for children's math competence are often gender-biased and can affect students' performance. Researchers proposed three things, among them the first one explains that teachers and parents their own math anxiety and beliefs also make differences in students' performance. Secondly, the gender rigidity and teachers' and parents' specific behaviors and mannerisms create links between them which helps to improve students' math attitudes from a young age. Pandit, D. R. (2006), the research was conducted to find the factors influencing learning disabilities in mathematics. Total 104 students from 29 rural and 15 urban areas participated in the research. It was based on those participants bio-data and found that poor instruction, parents' adverse and teachers' negligence were the main factors causing learning disabilities in mathematics.

Nepal. B. (2017). This study aimed to find out the level of mathematical thinking and achievement of the students of grade X in terms of gender and location. The researcher used quantitative research conducting a survey in three districts, Kathmandu, Sindupalchowk and Mahottatri. The survey covered 400 students for the sample and collected data was analyzed using t-test. This study resulted in no significant differences between male and female mathematics achievement. However, there is a significant different between rural and urban students on the level of Mathematical Thinking and Mathematics Achievements. Mohamed Z.G. Al-Agili, Mustafa Bin Mamat, Lazim Abdullah and Hamdan Abdul Maad (2012). The purpose

of this study is to determine the key factors that influence Libyan students' achievement in mathematics. A questionnaire of 30 items was distributed for Libyan students in Kuala Lumpur, Malaysia. The total number of the respondents was 201 (74 male and 127 female). One hundred and five students were in grade 4-6, eighty one students grade 7-9 and fifteen students from secondary school. Students were asked to respond to a 5-point Likert scale. Factor analysis technique was used and based on the Eigenvalues over one, six factors were identified. The combination of items, with loadings greater than 0.50, were considered as separate factors. These factors were Teaching Practices (which was recorded highly on loading), teacher' attribution, classroom climate, students' attitude towards mathematics and students' anxiety, in addition to students' mathematics achievement. Subsequently, confirmation factor analysis was conducted using the Structural Equation Modelling. The results showed that the teacher' attribution and students' attitude towards mathematics were the highest and lowest factors influencing the students' achievement, respectively. Moreover, the relationship among Teaching Practices and teacher attribution was high (0.68). Generally, good correlations were found among these factors in one hand and student's achievement in mathematics in the other hand.

Panthi, R.K.; Belbase, S. (2017). The research was conducted to put light on the issues that occur in mathematics teaching and learning. This study described the issues related to social aspects are gender issues, language issues, social justice issues, and issues related to the achievement gap. The culture issues are related to the diversity of language and ethnicity. The issues related to political aspects are equity and access, economic status, pedagogical choice, and professional organizations and unions. The issues related to technology include the technological skills, use of technology, and affordance in Nepal. It suggested the improvement of curriculum, teacher training and

resourcing the classroom and new technological tools. Soni, Akanksha, Kumari, Santha (2016). The study was conducted to find the factors that influence students' mathematics achievement and their choice to study further mathematics. The researcher conducted quantitative research with 875 students in total from grade five to ten and one parent of each in India. The research found that the 'mathematics anxiety' of students' parents and the attitude towards mathematics are the main reason behind students' achievement and their decision choosing mathematics in higher study.

Similarly, Mohammad Ahmad Al-Khateeb (2017). This study aims to discover the factors influencing students' mathematical achievement at the Hashemite University in Jordan from their viewpoints. The researcher generated quantitative research using a survey. It was conducted over 200 students (78 males and 122 females) and the result revealed that students' mathematical literacy level, beliefs about mathematics and some others and it suggested to reinforced students' understanding of mathematics historical context through mainstreaming the history of mathematics.

Conclusion

The purpose of this literature review was to find the existing research out there that is related to my research topic. It helped me to understand the gap that I was looking for. It is clear from the literature review that there are only a few researches that have been conducted in the related field in Nepal. However, all the literature was focused on a certain factor that influencing students' decision selecting mathematics in higher study which were unable to see the bigger picture that I wanted to find out. In addition, all these researches were based on quantitative study design, so they were not able to understand students' feelings and experiences enormously which was the gap that needed to address and fulfill. So, I thought it could be a very important phenomenon of the study to conduct in the present day.

Chapter III

RESEARCH METHODOLOGY

Methodology

This chapter describes the design of the plan and procedure of the study carried out to achieve the objectives of the study. This study applies qualitative research by doing one-on-one interviews, which helps to find out what are the major factors influencing students' decision to choose mathematics in higher studies. It determines the size of sample, tools for data collection, data collection procedure and also analyzing and interpreting the collected data. The results from this study intend to help mathematicians and curriculum makers understand what needs to be changed in order to develop mathematics teaching throughout Nepal.

Design of the Study

The design of the study was based on qualitative research. Qualitative research is a scientific method of collecting non-numerical data through observation and its approaches are employed across many academic disciplines, focusing particularly on the human elements of the social and natural sciences. This research is usually conducted to help to find answers for why and how a certain phenomenon may occur rather than how often. In this study, I used phenomenology design to understand participants' experience to get possible answers for the research.

Study Site

For the population of the study, the researcher conducted one-on-one interviews among grade ten students and teachers in higher secondary schools in Kaski district.

Sample of the Study

For my sample, I chose a convenience sample. I targeted students from grade 10 who are going to take SEE (Secondary Education Examination) exam and secondary school mathematics teachers. At this level, students begin to make decisions for higher study and choose which field they want to pursue advanced degrees. For collecting data, I wanted to get both gender participants from at least five schools including boarding and government. My goal is to get 10-12 responses. I contacted schools' administrators for the permissions and generated the interviews. After collecting data, I analyzed it with the help of the professor/teacher and evaluated the results.

Tool of the Study

To generate the interviews, the researcher constructed three lead questions based on my research topic with the help of the supervisor. The researcher also used a questionnaire which helped the researcher to keep focus on the topic and a tape recorder to minimize getting false information.

Procedure

I created at least five subjective questions in the interview simply asking how they decide what to study in further study, their mathematics experiences in the classroom. As I targeted students only from grade 10 who are going to take SEE, I constructed questions simple so that the questions can be understood easily by the participants. I tried to gather necessary information from different levels of students. There were only subjective questions included in the interview. I asked only subjective questions and collected their responses. To avoid the errors, I recorded everything on a tape recorder. The interview was not time consuming, it was around 10-15 minutes for each participant. Questions focused on overall students' mathematics experience throughout the school period. For example, has your experience with mathematics been

positive or negative? How would you rank your mathematics teachers? How well do you understand mathematics? Do you complete your homework? Responses will help me understand the data and make appropriate recommendations.

Data Analysis Procedure

The researcher used one-on-one interviews to find the possible result. To get the result, the researcher generated thematic analysis. First, the data was collected, categorized thematically and interpreted in a direct and narrative form. Conclusion was drawn after comparative thematic analysis and the interpretation of the data.

Chapter IV

ANALYSIS AND INTERPRETATION

Analysis and interpretation is the key to get the possible result in a research. It is also a process of assigning meaning to collected data, information, determining the conclusion, significance and implications of findings. For this particular research I have done one-on-one interviews with targeted participants. To avoid putting wrong information, the researcher also recorded the responses from selected participants. The participants were asked a few subjective questions based on the topic that has been selected by the researcher. I list the main and extracted the themes to analyze on the basis of data collected and relevant literature review. In this study, I used interviews with the help of recording.

Major subject they choose before SEE

Before students make their decision for their higher studies, they look back and make decisions depending on what they have been studying and what they studied in the past. It helps them to make choices easily. In the context of Nepal's education system, secondary school study covers up to grade twelve. However, they have to make choices while they are studying in grade ten.

Before students get to grade ten and take the SEE exam, the decision is made already. As we mentioned earlier, students' decisions are affected by the subject they choose in the previous level of study, students who take mathematics as their optional subject they are more likely to study STEM in the higher studies. If students have mathematics anxiety since their childhood then they are more likely to choose non-required mathematics subjects before they go on grade nine and ten. If they select economics or education or health as their majors then they are more likely to choose

management, humanities and nursing etc. Study showed that participants who are studying economics in grade ten, one of the participants Ranjit Dawadi said *"My decision will be based on what I am studying as an optional subject at the present. As my performance was poor in subjects like mathematics and science in DLE (District Level Exam), I thought, I cannot take mathematics as an optional subject because I was afraid of failing. So, I chose economics. And for further study, I want to pursue my career in management and I think I will do great".* It showed that students' decision is based on the subject they chose as an optional subject. However, surprisingly, the study also showed that those students who chose mathematics as an optional subject they are still less likely to study mathematics in higher study. Samir Nepali said *"I chose mathematics as an optional subject in grade 9 but, I do not think I am going to study mathematics in further study. Because I think there is no future studying mathematics".*

Mathematics Anxiety

Mathematics anxiety is another big factor that influences students' decision. Compared to other subjects students found that mathematics stands as one of an interesting and fun subject however, students are unable to do well in the exams.

Usually under developed and developing countries like Nepal where the education system is in poor condition, schools are running with low budgets and lack of required teaching materials which does not seem very helpful to subjects like mathematics and science. Because of this, students are afraid of failing the test and not doing well since their childhood, which creates anxiety for them. Most of the participants who chose non-required mathematics such as economics, health and environmental science said *"since we joined school we have this mathematics anxiety. As mathematics teaching has not been effective enough to provide a quality education, we are not able to construct solid concepts and generalize them which*

contributed creating anxiety among us. We feel mathematics is the most difficult subject ever. In the classroom, we barely understand 50% of mathematics. In addition there are tons of mathematical formulas to memorize, which is also a difficult task. In fact, we are less likely to study mathematics we are discouraged and try to keep ourselves away from it. As mathematics requires a lot of practice and brainstorming, we take it as a time consuming and frustrating subject which helps to make the mindset that mathematics is the most difficult subject ever". Meanwhile, Meece J.L., Wigfield A., and Eccles, J.S (1990) found that math anxiety has a direct impact on students' performance and perception, whereas it does not have a direct effect on their decision. On the other hand, based on the responses my study showed that math anxiety has at least a little impact on students' selection. Overall, According to participants' responses we can conclude that the teaching method 'lecture method' has not been changed at all in the classroom. Since their childhood, they never got a chance to learn things differently. So, the concepts of mathematics have always been poor and they are not able to create solid mathematical concepts. Eventually, they end up pursuing their studies in different subjects rather than mathematics.

Environment

Students also explained that community also plays a vital role in their decision making. How and where they are grown up? What kind of occupation do people do in the community? These aspects have influenced students' decisions. As they are grown up watching people' behaviours in the community like how they are living their lives and what are the jobs they do.

In the context of underdeveloped and developing countries, people are more likely to engage themselves in business field compared to others. One of the participants named through the one-on-one interviews with participants I came to the point that they

want to do something and become someone according to their experiences in the community and family. One of the participants named Sujan Nepali stated *"I want to become a businessman because my dad runs a bicycle workshop in the area and I see a lot of advantages running the business, so I believe that running a business could be the best way to live".* And another participant named Taiba Khatun described "I want to be a doctor because one of my neighbors is a doctor and watching this person since my childhood, I think being a doctor is one of the successful professions that I want in the future. From these responses I came to know that children' future is determined by the surrounding environment and who they get inspired from so, what kind of environment they get at home and who they meet everyday helps to set the mind for them. So, environment makes a big difference in terms of children's perception of the world and their goals in the future.

Parents' Decision

As parents are the first teachers to their children, children cannot make some big decisions without consulting with their parents. When students are in high school they are still not mature enough to decide what they want to become and do in the future.

Parents are responsible for their children's basic needs hierarchy as well as for their future. After SEE, students go through the stage where they have to make a very important decision for their future or career. To make the decision, students consult with their parents at first as they are the one who are investing for their children' future education. Before students make a choice about what they are going to study they prefer to get some suggestions and advice from their parents. Most of the participants stated *"we want to consult with our parents to make the decision because we are still very young to make these important decisions by ourselves. For this, we would like to have*

some suggestions and advices from them too as they are good at making decisions and have a lot of experiences. Moreover, they are the one who are still going to invest money for our further education and Parents' always wish their children to have a bright future, so we fully trust the decision that they make for us". Through their responses, I came to know that parents' decisions somehow affect their children's subject selection.

Financial Status

Parents make decisions based on their financial status. Because of education costs a lot of money. In today's world getting a quality education depends on the budget that you spare for. However, there are still some education institutes which offer good quality education with minimum cost. But if you look at the big figure, education has become a commercial. Craze for public schools and universities have been decreasing day by day as they are not able to provide remarkable education. One of the participants named Sommaya Tamang said *"I come from a middle class family and I have five siblings. My mother is a typical housewife, whereas my father is a taxi driver. My whole family expenses such as my siblings' education including me, food and clothes depends on my dad's income and sometimes he does not make enough money to cover all the expenses and we go through a hard time. Holding this kind of situation, my parents do not want me to study something that costs a lot of money"*. From this statement, we came to the conclusion that those who come from middle or lower class families are more likely to study something that can help them to get jobs as soon as possible and help them to cover all the family expenses. In order to get jobs easily, parents want their children to study subjects like nursing, management et cetera.

Students' Performance

Out of all the participants most of the students stated, performance as the main factor that influence their decision for higher studies. Students start figuring out their

choices when they are in grade 9. Lack of educated people around or the trend we have been seeing from generation to generation, our parents, teachers and seniors always have been giving career counseling based on our academic achievement. They limit their ability only on paper based tests and results which have been discouraging students to choose the field of study they are interested in. Most of the students said *"my decision was based on the SEE performance. I am not good at subjects like mathematics and science and I barely pass the exams, so I don't think I can study mathematics and science related fields of study in the future. I find them the most difficult subjects ever and I do not want to fail in the tests and ruin the rest of my life, but if I am able to do well in those subjects and get all the encouragement and confidence then I prefer to study STEM further. My parents and teachers also prefer to make suggestions based on our achievement in the test. As it makes them and us decide easily what to study further"*. According to their responses, I discovered that the assessment of their ability is determined by their performance in the test. However, even students who get good marks in subjects like mathematics and science, they do not show an interest in studying mathematics in higher study.

Mathematics Experience Overall

Most of the participants in the depth-interview responded 'mathematics' is one of the interesting and fun subjects. Except mathematics, other subjects like social, nepali includes a traditional teaching approach called 'lecture method' as well as 'teacher centered method' in which students can be only audience and they can not engage themselves in learning as they want so, students feel bored. Learning should not be boring. However, learning mathematics in schools is not as interesting as we expected. As mathematics requires a practical teaching approach, it can be taught more in practical manner but as we know education quality in Nepal has not improved over

the years. Ram Krishna Panthi (2017) mentioned that the issues relating to teaching and learning are coming from theories such as social and radical constructivism, which suggested that the teachers are not well trained and there is a lack of teaching aids, materials and technological tools. In fact, the old teaching approach 'teacher centered method' is being used in the majority of schools' mathematics classroom. Why are they unable to achieve good results in mathematics? And what are the problems they face while learning mathematics? Such questions helped to understand overall their experiences in the mathematics classroom. Participants responded *"I like mathematics because it is not like the other subjects where you just have to listen to the teachers' long speech. Mathematics is more fun and interesting compared to others, we can actually participate in the teaching procedure and we feel that we are somewhat involved in the whole classroom activities. It is the most difficult subject but at least teachers try to use the 'student centered' method in the classroom and we are a bit motivated. However, the quality of mathematics teaching in the classroom is not satisfied at all, which affects our mathematics' understanding. I barely understand 60-70% of mathematics everyday in the classroom"*. Through participants' responses we came to know that students' mathematics experience is not satisfying and it is one of the factors that affect students' achievement and their decision. It also shows that without having proper teaching plans, necessary materials and well trained teachers education goal cannot be achieved. Through participants' responses, I found some of the important points to be considered.

Difficult to make Mathematical Concepts

As we mentioned earlier that mathematics required a practical teaching approach, however, in the classroom applying practical teaching method is a very difficult task and they are time consuming. It seems like literally it is impossible to use

a practical teaching approach for every single contents in mathematics. But there is a very less effort being taken from the Government to provide a practical teaching approach in schools. In the context of rural areas in Nepal in where, the condition of mathematics education is very poor. Schools' students are even deprived of the text books. So, getting teaching materials, aids and technological tools are far beyond the possibilities. However, in urban areas the condition is not at the same level. Students said *"to provide a quality of education, I think teaching materials is a very necessary aspect of the whole teaching procedure. With the help of required teaching materials, teaching and learning can be more effective. They help us to generalize and understand the mathematical concepts visually and for the conceptualization. However, in the context of school geometry, we can see that teaching materials are being used by the teachers but still it does not seem to be sufficient. As a result, we are not able to create concrete mathematical concepts and because of this we do not feel comfortable selecting mathematics in higher study and do well".*

Memorizing Formulas

Formulas deal with every single aspect of mathematics. In mathematics, a formula generally refers to an identity which equates one mathematical expression to another. Syntactically, a formula is an entity which is constructed using the symbols and formation rules of a given logical language, so it has an important role in mathematics.

Some of the students responded *"there is an absence of generalization and conceptualization. We try to memorize the formulas just to solve the mathematical problems and pass the test. But we never understand where those formulas come from and how they are being formulated. If we are able to see how they are constructed, it is going to be a lot easier for us to conceptualize. But often mathematics teachers use an*

inductive teaching approach rather than deductive in the classroom, which does not seem to be very helpful to us understanding the mathematical formulas and it forces us to learn formulas by rote". From this, I came to know that most of them find mathematical formulas are difficult to memorize and how and where to apply them. In fact, students are frustrated and discouraged. Eventually, they do not do well in the test and fail.

Job Opportunities

Another big factor that came out through interviews is 'job opportunities'. In order to live a good life, everyone is seeking a good job and payment. People spend a big part of their budget to get good degrees as they wish to have a bright future and easy lifestyle. So, the job opportunities become an important factor influencing students' decisions.

Most of the participants reported *"we make our decision for study based on the opportunities we can have and good income we can get. This is a very important decision for us as we are going to make sure that our future is secure. Which means,25 we need to get decent jobs with plenty of opportunities. For an example, if we look at today's trend, there are a lot of opportunities in the business sector like running hotels, restaurants, banks and furniture shops et cetera which also seem to help creating more jobs for people. As a result, everyone sees these professions as a successful and good life they wish for the future"*. And I asked the participants during the interview why don't you want to study Mathematics? And they answered *"studying mathematics, there is no future. Moreover, we do not even know what kind of job opportunities we can get studying mathematics and we see there are limited options for us after finishing our studies. Whereas, we see a lot of opportunities out there, studying non-required mathematics subjects. For instance, in the field of Business, Health et cetera"*. As a

result I could say job opportunities can be considered as a strong reason behind not choosing mathematics in higher study.

Applied Mathematics

Application is a very important aspect of learning. In other words, there is a direct relation between learning and application. As we know that without mathematics this world cannot move even an inch, so every single day to day life activities we apply mathematics because of it, our lives have become easier. Moreover, mathematics also helps other fields of study like science, management, doctor and engineer et cetera directly or indirectly. So, we could say that the world exists because of mathematics.

In the context of underdeveloped and developing countries like Nepal, the Government is not giving any importance to this phenomenon. In fact, students do not see the importance of mathematics after high school is completed. Even though I am a mathematics student, it is very difficult for me to generalize those mathematics concepts in real life. So we can imagine how impractical mathematics education is in Nepal. Students responded *"we think that high school mathematics is sufficient to tackle mathematics problems in our daily life and further study is not really necessary as it cannot be applied day to day life. In other words, higher study mathematics is being used to just pass the exams and get degrees only. Moreover, it does not make any contribution to the community and there will be a few opportunities for us to take in like teaching profession, being a government employee"*. Analyzing their answer I came to know that the nature of mathematics is another main factor influencing students' decision selecting mathematics in higher study.

Mathematics Learning Environment

The outcome is always determined by the environment. In the field of education, the learning environment directly impacts students' achievement as well as their

decision for higher study. If the classroom environment is not very motivating, then students' interest towards mathematics will slowly decrease. So, the teachers should be aware of this phenomenon and try to energize the classroom activities.

Participants stated *"the teaching method is always the same 'teacher centered' and it is not practical based, which is not helping us to keep our interest towards mathematics and mathematics itself is a difficult subject as compared to other subjects. As teachers are responsible for all the activities in the classroom, they should know how to lead the class, they should be able to manage the classroom and try to make the most out of it, but Some of the teachers mostly give their attention to bright students not those students who need the most help. Because of this, bright students always get the most help, whereas weak students always get behind. In fact, weak students like us got demotivated by the teachers' this kind of behavior while learning. Moreover, teachers who come from different study backgrounds are not getting any sort of teaching training. We see teachers as leaders, advisors, parents and a role model. So, they are carrying the most responsibilities. To fulfill the responsibilities, not only teachers but also parents, curriculum makers, and Government should try to create a friendly and motivating environment for students"*. The information that I gathered from some of the participants shows that they are demotivated by the activities in the classroom. The way of teaching, teachers, classroom management are not satisfying.

Teacher Related Factors

Teacher training

Teachers are the ones who are responsible for all the teaching related aspects for school, students and country. In order to provide a good quality of education, teachers should get trained and up to date with every development in the world that takes place in the related field. So, Government of a country should organize regular

training for teachers to make them updated. Teacher named Khem Raj Bhattarai said *"there is no training for teachers. I think teachers should be provided with such training which helps us to keep updating everything that is related to the field. Such training also creates an opportunity for teachers for a meet up, which also helps to boost teachers' skills in the field of mathematics teaching. In this point of view, I think it is very important to build necessary skills to provide a quality of mathematics education"*. Moreover, these trainings provide opportunities to the teachers to gather and share their experiences, problems, suggestions etc. which will definitely enhance teachers' abilities and their professional career as well.

Accessibility of Teaching Materials for Teachers

Due to the advancement of technology in the modern era, the way of teaching has changed a lot in the field of education in the world but unfortunately, in Nepal the education system has not got upgraded so much as compared to other developing and developed countries. It has mostly affected subjects like mathematics, science etc as these subjects required practical teaching approach. Teacher Narayan Shrestha said *"we are provided some of the necessary materials but not everything that we need. As we know mathematics requires a practical teaching approach but due to the lack of teaching materials especially for geometry, students always struggle to make concrete pictures. I think having solid teaching materials to show students would definitely help students to make solid concepts and clear pictures and it also helps overall teaching activities in the classroom. I also found that when I use teaching materials in the classroom, students are more likely to show more interest and motivate themselves"*. Through my experience, still the majority of schools in Nepal are running without necessary teaching aids and materials. As a result we could say that teachers are not provided enough materials to use in the classroom, some schools do have materials but

they are outdated, damaged and not in functions. Which directly impact the quality of education.

Consultation with Teachers

Consultation with teachers seemed to affect students' decisions for their higher studies. As we mentioned earlier, teachers have all the responsibilities to provide a quality education for students. In addition, teachers are also a consular and advisor to lead students on the right path and help them to make decisions for a good career and a bright future ahead. Outside the home students spend most of their time in the school with teachers so, teachers are the ones who closely evaluate and examine students' behaviour, attitude, and progress. Since students join schools, they believe their teachers more than their parents in terms of study. Both teachers responded "*before they decide what to study further, they always like to get some advice from their respective teachers. They believe that we do have more academic knowledge, we have a better understanding of subjects selection for their further study. So, they always want to consult with us before they make their decision. In addition, we also want our students to have a bright future, have a good job and be satisfied. So, according to our knowledge and understanding we try to provide best suggestions as possible. Usually, after grade 8 students slowly start thinking what they want to study further and pursue their career on, since this time, they start asking for suggestions and advice".* So, according the teacher' responses, I came to know that teachers can be the factor influencing students' decision selecting mathematics in further study

Chapter V

FINDINGS AND CONCLUSIONS

Findings

Findings Based on Students' Responses

According to the literature review, we found that most of the research that has done so far focused only on particular factors and based on quantitative research. My research tried to cover a bigger picture with qualitative based one-on-one interviews.

In depth interview really helped me to understand students' feelings and experiences towards mathematics deeply. Analyzing the students' responses I was able to find that there are a total of eight factors that play roles in students' decision for higher study. Among them, Mathematics anxiety still remains as the main factor affecting students' subject selection. Moreover, through participants' responses the study also showed that job opportunities and application of mathematics have the same contributions on decision making for students for higher study. Despite being a more interesting and fun subject compared to others, overall students' experiences in mathematics are not satisfied at all.

Findings Based on Teachers' Responses

Through the interview with teachers from schools provided me an opportunity to learn more about teaching procedure, classroom activities and teachers' perception towards mathematics.

The teachers came with three different points to consider. According to their responses, overall the mathematics education system and the teaching procedure do not seem to be very engaging and effective. Lack of teacher training is a factor that influences the whole teaching procedure. Teaching training would definitely provide a

platform where teachers from different backgrounds can meet up and share their experiences and help each other and make an improvement in the teaching field. Similarly, there are not enough teaching materials and Even there are, they are outdated and not in a good condition. And lastly, consultation with teachers seems to affect students' decision selecting mathematics in higher study. Because students want to consult with their teachers to get some suggestions before they make their decision.

Conclusion

From the analysis it was found out that:

- Almost all of the participants pointed out that the 'performance' is the main factor influencing their decision for further study. They believe if they get good results in mathematics and science only they will be able to study STEM.
- Students are more likely to consult with their family, friends and seniors and get their suggestions and advice.
- Surrounding people' profession also affects students' decisions indirectly. Students make the mind set or goals by seeing what kind of jobs people do in their surroundings.
- Mathematics anxiety also plays a vital role in students' decisions. They feel mathematics stands as the most difficult subject compared to others so they do not want to study mathematics further as they are scared of failing.
- Even students choosing mathematics as an optional subject in secondary schools that does not mean they are going to study mathematics in further study. They showed interest in studying management, science etc.
- Students also make decisions about what to study based on the job opportunities they will have after completing their studies or while studying. For an

example, if they see there are less job opportunities studying mathematics in the future then students are less likely to choose the subject in further study.

- Almost all the students find mathematics to be a more fun and interesting subject out of all the subjects. However, students are not satisfied with the overall mathematics experiences in the classroom.
- Based on students' responses, It is also clear that mathematics is not practical in nature, students are not fully confident that their future is not going to be secure and successful and also mathematics concepts do not seem to be generalized, students are not willing to study mathematics in higher study.
- Most of the students responded that generalizing the mathematics concepts, memorizing mathematical formulas and being able to make a solid concepts are the main problems they face while learning mathematics in the classroom.

Limitation of the Study

The present study has the following limitations

- This study only focused on finding out the factors that influence students' decision to select mathematics in higher study.
- The study covered only five schools including three public and two private in Kaski district.
- To get the possible result, the researcher generated one-on-one interviews with the targeted participants. The participants were from grade 10 as they are the ones going to make decisions for higher study.
- The sample size of this study is limited to 12 participants which included both students and teachers from secondary school.
- The interview lasted for 15 minutes for each participant.
- The study was based on secondary level school mathematics.

Suggestion for the Future Research

The suggestions are as follows

- This study was limited to a few schools in the Kaski district, so the research can be conducted to many districts including rural and cities areas with larger sample sizes in the country.
- There can be other factors that may influence the students' decision choosing mathematics in higher study such as gender, parental socio-economic factor etc.
- The mathematics curriculum can be the big reason behind students not being interested towards mathematics, so a research can be conducted to evaluate the significance of the mathematics curriculum.

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APPENDIX A

PUBLIC SCHOOLS

Students' Name	Optional Subject	School Name
1. Bimala Thapa Magar	Math	Shree Barahi Secondary School
2. Ranjit Dawadi	Economics	”
3. Sommaya Tamang	Math	Shree Nabin Secondary School
4. Asmita Tamang	Health	”
5. Madhu Sudan Basyal	Economics	Shree Janapriya Secondary School
6. Krish Paudel	Math	”

PRIVATE SCHOOLS

Students' Name	Optional Subject	School Name
7. Salina Gurung	Math	Havard Academic
8. Sonam Pun	Environmental science	”
9. Sajina Jugjali	Math	Lekhnath Vibhuti
10. Sajan Thapa	Environmental Science	”

TEACHER

Teacher Name	Subject	School Name
11. Narayan Shrestha	Math	Nabin Secondary School
12. Khem Raj Bhattarai	”	The Rising Star Academy

APPENDIX B

SEMI STRUCTURED INTERVIEW QUESTIONS

1. How do you decide what to study further?

a) Do you consult with your parents/ teachers/ seniors?

2. What will you study further? And why?

3. Why don't you want to study mathematics in further study?

4. How do you describe mathematics experience overall?

a) Is mathematics difficult/ boring/ interesting/ fun? And why?

5. What are the problems, Do you face while learning and teaching mathematics?

a) Is it difficult to memorize the formulas? Why? Why not?

b) How teaching approach be improved?

c) Is teacher training necessary?

d) Are there enough teaching materials in the school?