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Teachers' Perception on Reducing Students' Enrollment at University level in Mathematics in Nepal

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Abstract

Background: Students' enrollment taking mathematics as a major subject has decreased at the university level in recent years. Difficulty in subject matters, the attitude of students, the learning environment, uses of mathematics knowledge in real life, and existing evaluation systems could influence learners' enrollments at the universi- ty level. The purpose of this study is to identify causes for reducing the learners' enrollment at a higher level in mathematics.

Objective: This study desires to investigate the perception of teachers on the dependent variable as a reduction of students' enrollment in mathematics and independent variables, namely difficulty in subject matters, the attitude of learners, learning environment, application of mathematics in real life, and existing evaluation systems and find relation and influence.

Methodology: This inquiry consists of 109 faculty members with qualifications of master's degree or above in mathematics based on the survey research design in Pokhara valley and its surrounding. A three-point Likert-scale survey questionnaire, 31 structured questions related to dependent variables and independent variables was made and administered by the researcher to the teachers.

Result: This study concluded that reducing learners' enrollment is remarkably confidently correlated with the attitude of students, learning environment, difficulty in subject matters, and the existence of evaluation patterns. This finding further found that the learning environment and existing evaluation system are directly impacted by reducing the students' enrollment, but other independent variables do not have an influence on the dependent variable, namely perception towards reduction of student enrolment in mathematics.

Conclusion: The learning situation and actual judgment system are highly affected by reducing the students' enrollment at a higher level. These two independent variables should be managed by research to address the learners' interest and demand within a short time interval as an international system. Further study about the perceptions of teachers in pure mathematics and applied mathematics should be done separately to generalize and validate this finding.

Keywords: Decline, enrollment, environment, evaluation, perception

JEL Classification: C60, I10, I23, I29

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Introduction

Assumptions, properties, and applications are the major key points of any subject. The study of the assumption, properties, and applications of numerical-related topics is called mathematics. Different parts of mathematics have different assumptions, properties, and applications. Mathematics is a subject that studies numbers, logic, shapes, quantity, and arrangements (Hom & Gordan, 2021). It plays a significant role in diverse fields in our real life such as engineering, economics, business, finance, natural science, and medicine. Even though enrollment of students in general mathematics courses has increased slightly from 2001 to 2013, the enrollment of learners in extension courses of mathematics has rapidly decreased over the recent years (Wilson & Mack, 2014). The course of pure mathematics is abstract and rigorous. Most of the topics of pure mathematics include a more theoretical part and fewer counterexamples. The curriculum of core mathematics has not explained the application part of math in the real field. Most of the learners focused on the applied field of mathematics. They gave less importance to the extension course of mathematics.

Poor marks in exams encouraged the learners to dislike mathematics (Ukobizaba et al., 2021). The pass rate of mathematics of learners was below that of other subjects. With the problem mentioned above, Learns' enrollment in taking mathematics as a major subject has reduced at a higher level in recent years. The study could support the teacher to motivate, inspire, and guide the learners to learn mathematics by explaining the function of mathematics in further studies. This study aims to explore the major problems of learning situations, and existing judgment systems for the low rate of passing- out in mathematics the exam. Thus, it could play a significant role in eliminating the main problems and create good learning environments and update evaluation systems to address learners' interests and needs. Further, this study may provide sufficient ideas for pupils to innovate in mathematics in its applied field. Moreover, it is expected that the findings from this could provide a remarkable suggestion to reform the course content and elaborate the application part.

Review of Literature

The problem-Based Learning Model can be considered an appropriate tool for achieving intended learning outcomes, interesting and more participating students' activities, and making an easy and comfortable environment for learners to understand subject matters and connect knowing mathematical knowledge to real life (Apriliyanto et al., 2018). The problem-based learning model is a kind of Students Center Teaching Learning Activities (SCTLA). Teachers have to achieve sufficient knowledge for this method. Course contents of mathematics should be updated for the SCTLA approach. Mazana et al. (2019) explored that positive attitude toward mathematics was decreasing from beginning classes to higher classes. The enjoyment and attitude of mathematics were directly correlated with the learner's achievement. Liking or disliking this subject was determined by the output of the result of mathematics. The mathematical concepts, ideas, and application part have to be taken seriously in junior classes. Zhang et al. (2019) indicated that vigorous anxiety about mathematics played a stronger negative significance in the studies of Asian mathematics learners than in mathematics learners of European. Moreover, math anxiety had negative effects on the performance of math at a higher level than elementary groups. Hine (2018) explored that mathematics was a more rigorous and less applicable subject and mathematical knowledge at the secondary level was not essential for the entrance of other viable subjects at a higher level of education in Australia. It indicated that less rigorous and more applied courses in diverse fields attracted new learners. Tyata et al. (2021) found that project-based learning (PBL) was the most suitable pedagogy for the teaching and learning activities of mathematics. The fact-finding revealed that PBL was highly appropriate to engage the learners through group discussion, discovering learning,

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questioning, and concept mapping. Moreover, that method motivated the learners by applying interactive ways. PBL was student center teaching-learning activities that were guided by constitutive interests, and collaborative and cooperative learning.

Mathematics was not a favorite subject for most students due to boredom, fear, low self-efficacy, and negative expectations of mathematics (Gafoor & Kurukkan, 2015). More positive effects like higher self-efficacy order, interest, positive expectations, and personal values play a significant role in favorite mathematics learners. A positive attitude toward mathematics supports the learners to like mathematics. Finance and banking, computer and its game, weather prediction, search engine, logistics, music, Transportation, satellite navigation, crime prediction, military, and defense are the most common and essential applications of advanced applied fields of mathematics in real life (Gupta, 2019). Basic and advanced knowledge of mathematics is required in diverged fields.

Online course modality was not an appropriate alternative way of teaching-learning activities of all level courses (Counterman & Zientek, 2021). Subject matters and achievement in mathematics required more face-to-face courses. Semi-structured schedules, frequent interaction, and prompt feedback with students and teachers were suitable for middle and upper-level courses in mathematics. The students-centered face-to-face teaching-learning activities model was suitable for all levels of course of math to achieve remarkable results.

Teachers, students themselves, and the learning environment were the major points for the difficulty of mathematics for learners (Langoban, 2020). Most of the learners had insufficient knowledge about mathematics from the previous class. Most of the faculty members of mathematics were unable to connect the subject matters of mathematics to real life. The learning environment in different academic institutions was not positive for mathematical learning, that's why mathematics becomes difficult for students. Shrestha et al. (2021) revealed that mathematics was complicated, abstract, and rote memorization which were three critical concerns in learners' experience of learning mathematics. The poor responsibility of parents and difficulty adjusting to the new environment in the new school were the main reasons for the decrease in learners' performance in mathematics. So the school should launch a special program for the new learners to adjust them to new environments. The curriculum and teaching methodology should be changed to make them applicable, concrete, and easy.

Kunwar (2020) explored those occupations and education of parents played a remarkable role in learners' achievement in mathematics. This study also found that students obtaining marks were directly related to their parent's occupations. Students' honesty, teacher's evaluation fairness, students' active participation, transparency in the education system, and the occupation of parents play a significant role in achieving good scores in mathematics. Akhter and Akhter (2018) revealed that the attitude of students was a major part of the learning of mathematics of learners. Students having positive attitudes towards mathematics supported them to understand mathematics comfortably. The negative attitude or perception of learners towards mathematics of students should be changed for increasing the demand for mathematics.

The innovative method of mathematics was viable for those students who were weak in mathematics. This method enhanced the learners to motivate, encourage, increase the rate of interest, and apply mathematical knowledge to real life. Negative attitude, disliking mathematics, and getting low grades in mathematics was improved by using an innovative method of mathematics (Woodward, & Baxter, 1997). The curriculum of mathematics should be reformed for this method. Different types of mathematical content have to be included for innovative mathematics. An incentive through private and public funding schemes, Skills – based on technological change in higher education degrees, the rising social reputation of education, and incentive to achieve college degrees were required in part for the expansion

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of higher education (Beblavy et al., 2014). The rule of government and universities made huge funds for incentives to degree holders. Government should identify required education for national needs and provide sufficient funds for research activities and learners of degree holders in mathematics.

Technology has been invented rapidly. The world is becoming small due to the use of technology. Every unexpected activity became possible with the help of modern technology. Simply Counting and arithmetic, weaving, building, and other business, solving technological problems by using calculus, and solving technological and mathematical problems by using a computer were all the products of mathematics (Hansson, 2019). The study explored the hybrid concept of usefulness and computation of mathematics in technology. Technology was the product of the philosophy of technology and the philosophy of mathematics. Mathematics was the fundamental tool of technology.

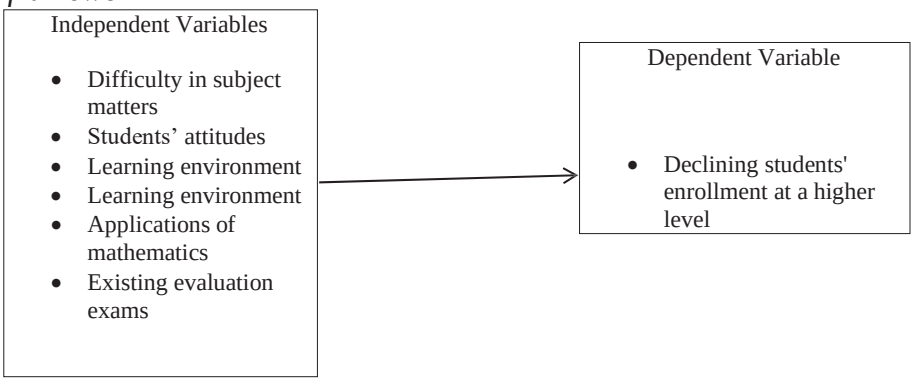
Learners' enrollment has reduced at the higher-level taking mathematics as a major subject in recent years. This investigation aims to identify the problems of reducing student enrollment at the university level in mathematics. From the above theoretical and empirical review, the difficulty of course content, learning environment, the attitude of learners, application of mathematics in real life, and evaluation systems play a significant role to like or dislike mathematics.

Mathematics was more rigorous and less applicable than other disciplines in real life (Hine, 2018). Also, mathematics was abstract, complicated, and had rote memorization. The lack of responsibility of parents and difficulty adapting to the new environment in the new school were the key points for reducing students' performance in mathematics (Shrestha et al., 2021). The low grade obtained in exams encouraged the students to dislike mathematics (Ukobizaba et al., 2021). The positive attitude of students toward mathematics was decreasing in higher-level classes (Mazana et al., 2019). From the above-mentioned points, pupils do not like to study mathematics at a higher level. So, the enrollment of learners taking mathematics as a major subject was lower at the university level.

Moreover, faculty members of mathematics are one of the key factors for teaching learning activities. This study desired to recognize the perception of teachers on decreasing the learners' enrollment at a higher level in mathematics with the constructs such as difficulty in subject matters, the attitude of learners, uses of mathematics, learning environment, and evaluation system in Pokhara valley and its surroundings. Such types of research studies have not been done at Pokhara valley and its surrounding. The purpose of this study is to identify the cause of declining learners' enrollment at the university level in mathematics. The conceptual framework of this study has been presented below. The Independent variables and dependents variable of this study are as below:

Figure 1

Conceptual framework



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Materials and Methods

The study utilized both descriptive and analytical research design by using the quantitative research method. The inferential statistical tools like mean, standard deviation, correlation, and regression analysis showing the impact of independent variables on dependent variables were used in this study. Finding the perception of the teacher to reduce the learner's enrollment at the university level in mathematics was aimed to apprehend this investigation on independent variables. The researcher had prepared 7 demographic variables and 31 structured questionnaires among them 5 for the decline in the enrollment of students, 5 for the difficulty of subject matters, 6 for the attitude of students, 5 for the learning environment, 5 for the application of mathematics, and 5 for existing exam patterns based on the research questions. Structured questionnaires were used in this study. The data are collected from the questionnaires and analyzed using the statistical software SPSS version 20. The data from questionnaires were checked and the validity and trustworthiness of the results were. This study was especially used to identify the perception of teachers on declining student enrolment in mathematics at the university level on independent variables.

The target population for this study embodied the tutors in mathematics whose qualifications were master's or above within Pokhara valley and its surrounding. All faculty members of mathematics who had taught mathematics at the university level and secondary level of the school during the data collection period constitute the population in this study. The data was collected from 2022 Jun to 2022 August through 40 field visits and 69 online. The sample size was determined by non-probability purposive sampling which consisted of 50 science backgrounds, 26 education backgrounds, and 33 art background tutors who were involved in the teaching profession. Most of the faculty members of mathematics were included in these study areas.

Internal Consistency of the Perceptions Category

The Internal consistency of the items has been depicted in table 1 using the reliability coefficient Cronbach α-value. Taken together, we utilized a total of 31 items in the questionnaire. The overall reliability coefficient was found to be 0.893, which indicates that the items employed in the questionnaire were consistent.

Table 1

Reliability Analysis

S.N	Constructs	No. of items	α-value
1	On declining enrollment of students in Mathematics at Higher level	5	0 .809
2	Difficulty in subject matters	5	0 .764
3	The attitude of learners’	6	0 .877
4	Learning Environment	5	0.835
5	Application of mathematics	5	0 .819
6	Existing evaluation systems	5	0 .725
	Total items	31	

Further, table 1 shows the reliability coefficient of each of the designed constructs such as the declining reason for enrollment in mathematics, difficulty in subject matters, the attitude of learners, and so on. The result shows that the reliability of the constructs was the highest at 0.877(the attitude of learners) and the lowest at 0.725 (the existing evaluation systems). All constructs were reliable because all of them were greater than 0.70.

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The plan was especially used to find the rigorous feeling of faculty members facing mathematics on the topics of the declining students' enrollment at a higher level, attitude of students, difficulty in subject matters, learning environment, an applied field of mathematics, and evaluation systems. The arithmetic means and standard deviation (SD) of each structure questionnaire of each construct were computed by applying the software SPSS version 20 and the outcomes were analyzed. The relationship of construct variables and the impact of independent variables on dependent variables were calculated by using correlation and regression matrix.

Results and Discussion

Demographic Profile of Respondents

In this study, 109 mathematics teachers participated in the survey. Among 109 respondents, 97.20 % were male and 2.80 % were female. It explains that few females studied mathematics at a higher level. 76.1 % live in Municipality and the rest 23.90% live in Villages. Most of the respondents live in a valley. Among these 109 appellants, 21.10 % of the ages are below 30 years, 29.40 % of the ages are 30 to 40 years, 38.50% of the ages are 40 to 50 years, and 11.00 % of the ages are above 50 years. It described that the age of most faculty members of mathematics lies between 40 to 50 years.

Different respondents have different qualifications, 89 % of appellants have a master's degree, and 6.40% have M.Phil. And 4.6% have Ph.D. qualifications. It revealed that only a few mathematics tutors were interested in further study after passing their master's degree. 89.90 % of the applicants were married and the rest 10.10 % were single. 94.50 % of respondents have a main income that depends on only teaching and learning activities and the remaining 5.50 % have different income rather than teaching and learning activities.

Descriptive Analysis of Difficulty of Subject Matters

For descriptive analysis of the study means and standard deviation are applied for testing the position of constructs of the perception of teachers on the above-mentioned dependent variable and independent variables.

Table 2

On Declining Enrollment of Students in Mathematics at a Higher Level

		N	Mean	SD
1	Students' enrollment in mathematics at a higher level is decreasing each year.	109	2.917	0.363
2	The curriculum of mathematics at a higher level is less useful than other subjects.	109	2.918	0.388
3	The ability and experience of students are not good in mathematics.	109	2 .898	0.407
4	Most subject matters of mathematics are not connected to our real life.	109	2.899	0.438
5	The rate of passing out students in Mathematics at a higher level is less than in other subjects	109	2.954	0.285

According to table 2, the majority of the faculty members agreed that the rate of passing out students in mathematics at a higher level was less than in another subject with a mean of 2.954 and a standard deviation of 0.285. But a minority of the teachers agreed that the ability and experience of students were not good in mathematics having a mean of 2.898 and SD of 0.407.

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Table 3
Difficulty in Subject Matters

		N	Mean	SD
1	I think that only a few students understand mathematics problems.	109	2.450	0.739
2	I realize that only a few students prefer their friends to study mathematics at a higher level	109	2.679	0.591
3	I feel that the mathematics curriculum is not flexible for different levels of students.	109	2.743	0.516
4	I think that mathematics is relevant to further studies.	109	2.817	0.389
5	I think that the existing curriculum of mathematics is not focused on a problem-based learning model.	109	2.66	0.581

The outcome was demonstrated in table 3 with the largest mean of 2.817 along with an SD of 0.389. It said that most of the respondents realized that mathematics was relevant to further studies. The smallest mean of this table was 2.450 with a standard deviation of 0.739. It concluded that minor respondents agreed that only a few learners understood mathematics problems.

Table 4
Attitude of Students

		N	Mean	SD
1	I feel that most of the students have a negative perception of mathematics.	109	2.530	0.701
2	I realize that only a few students of mathematics have the ability and experience to study mathematics.	109	2.743	0.599
3	I think that only a few students have interested to study mathematics in further study	109	2.844	0.434
4	I feel that most of the students have insufficient mathematical knowledge to apply in the real field.	109	2.807	0.441
5	I think that most students do not like to ask mathematics teachers and friends.	109	2.596	0.610
				0.303
6	I realize that only a few students like to innovate in mathematics.	109	2.899	

This Table 4 explained that most teachers realized that only a few learners liked to innovate in mathematics with a mean of 2.899 along with an SD of 0.303 nevertheless fewer faculty members felt that most of the learners had negative perceptions of mathematics with a mean of 2.530 along with an SD of 0.701.

Table 5
Learning Environment

		N	Mean	S.D
1	I feel that most campuses have given less priority to mathematical activities.	109	2.918	0.277
2	I feel that most people could not connect their mathematics knowledge to real life.	109	2.917	0.308

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3	I think that most of the student's family has negative perceptions of mathematics.	109	2.706	0.628
4	I think that only a few faculty members of other subjects have a negative perception of mathematics.	109	2.743	0.599
5	I feel that only a few people related to mathematics are involved in mathematics research activities.	109	2.826	0.448

The result of table 5 described that most teachers felt that most of the campuses had given less priority to mathematical activities with a mean of 2.918 along with an SD is 0.277 however fewer teachers thought that most of the student's families had negative perceptions of mathematics with a mean of 2.706 along with SD is 0.628.

Table 6

Application of Mathematics

		N	Mean	SD
1	I feel that mathematics is a more applicable subject than other subjects.	109	2.881	0.402
2	I think that mathematics knowledge can help the study of another subject.	109	2.963	0.189
3	I feel that mathematics ideas help learners to develop more creative, imaginative, problem-solving, constructive, and logical skills than other subjects.	109	2.954	0.210
4	I think that the Curriculum of mathematics is not focused on the job orientation, behavioral, and life orientation of learners.	109	2.872	0.387
5	I feel that the Curriculum of mathematics does not include sufficient examples and ideas about Science, Technology, Engineering, Economics, and Business.	109	2.844	0.455

The outcome of table 6 showed that the largest average was 2.963 with a standard deviation of 0.189 and the smallest mean was 2.844 with an SD of 0.455. Most of the replies felt that mathematical knowledge can help the study of another subject. Only a few replies concurred that the curriculum of mathematics did not include sufficient examples and ideas about Science, Technology, Engineering, Economics, and Business.

Table 7

Existing Exam Patterns

		N	Mean	SD
1	I feel that the question pattern of mathematics is not different for weak and talented students at the same level.	109	2.835	0.462
2	I think that existing exam patterns do not provide chance exams within a short time.	109	2.844	0.434
3	I feel that most of the students have feared presenting in mathematics exams.	109	2.817	0.530
4	I think that the question pattern of mathematics is harder than other subjects.	109	2.596	0.771
5	I feel that question papers on mathematics do not include innovative parts of mathematics.	109	2.697	0.616

The result of Table 7 explained that most teachers thought that existing exam patterns did

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not provide chance exams within a short time with a mean of 2.844 along with an SD 0.434 however fewer teachers thought that question pattern of mathematics was harder than other subjects with a mean 2.596 with an SD 0.771.

Table 8

Correlations between Dependent and Independent Variables

	Declining students enrollment	Difficulty in subject matters	Attitude of students	learning Environment	Application of Mathematics	Existence of exam pattern
Declining students enrollment	1	0.182	0.311**	0.405**	0.038	0.379**
Difficulty in subject matters		1	0.361**	0.243*	0.128	0.154
Attitude of students			1	0.506**	0.304**	0.547**
learning Environment				1	0.198*	0.434**
Application of Mathematics					1	0.279**
Existence of exam pattern						1

Table 9

Regression Analysis showing Effect of Independent Variables on the Dependent Variable, Decline of Students in Enrollment in Mathematics:

Model	B	T	Sig	VIF
(Constant)	9.668	5.939	0.000	
Attitude of students	0.019	0.290	0.772	1.827
learning Environment	0.216	2.698	0.008	1.423
Application of Mathematics	-0.119	-1.198	0.234	1.125
Existence of exam pattern	0.186	2.419	0.017	1.535
Difficulty in subject matters	0.053	0.823	0.412	1.164

The variance inflation factor (VIF) was less than 5, and the VIF of all the variables had not more than 1.827. It meant that there was no multi-co-linearity in any constructs of the study. The P value of the learning environment was 0.008 which was less than 0.05. The coefficient value of β was 0.216 so the learning environment positively impacted on declining enrollment of students in mathematics. The P value of the existing exam pattern was 0.017 which was below 0.05 and the coefficient value of β was 0.186. Based on this information, the existing

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exam pattern significantly affected reducing enrollment of students in mathematics at a higher level. The p values of the attitude of students, application of mathematics, and difficulty in subject matters were less than 0.05 from table 9. So the uses of mathematics, the attitude of learners, and difficulty in subject matters were no signs of declining students' enrollment at the higher level in mathematics. The value of the R-square is 0.231. Based on the coefficient of determination (R^2), it can be concluded that 23.10 percent of changes in the dependent variables are influenced by independent variables.

The major finding of this study was that decreasing student enrollment was highly influenced by the learning environment and existing evaluation system. Most of the faculty members positively trusted that the pass percentage of learners in mathematics is below that of other disciplines. This finding is consistent with the study by Ukobizaba et al. (2021) that concluded that lower achievement in exams supported students to dislike mathematics. This study found a similar conclusion. Kunwar (2020) revealed that employment and education of guardians showed a significant role in learners' good performance in mathematics. This study found supportive results with the learning environment affecting the student's enrollment.

Moreover, this study assessed that reducing learners' enrollment at a higher level in mathematics was remarkably correlated with the difficulty in subject matters, attitudes of learners, learning environment, and the evaluation process. Learners' achievement in mathematics had decreased because mathematics was abstract, rote memorization, and complicated, and the carelessness of parents' responsibility and difficulty adapting to the new surroundings of the new school (Shrestha et al., 2021). This study also found a similar argument. Mathematics was a more rigorous and less applicable subject compared with other subjects (Hine, 2018). This study also supported this argument because most of the respondents agreed that the curriculum of mathematics at a higher level was less viable than other equivalent subjects.

Furthermore, the result of this study explained that most people were unknown to use their mathematical knowledge in real life, and only a few learners were interested in innovating in mathematics. Only a few colleges provided priority for mathematical activities. These all statements reported that the teaching-learning environment of mathematics was poor. Different types of vocational training should be conducted to apply mathematical knowledge in different sectors such as agriculture, construction of buildings and roads, tailoring, furniture, sports, designing, and so on. Different research activities about the application of mathematics in the local area should be done to improve the learning environment of mathematics. The evaluation system and its affected components should be changed to increase learners' pass percentage.

Conclusion and Recommendation

Teachers' perception of reducing learners' enrollment was due to the rigorousness in course content, attitude of learners, learning environments, uses of mathematics in real lives, and existing evaluation systems. Also, few teachers believed that the ability and experience of learners were not fine in mathematics, only a few students knew mathematics problems, most of the learners and their families had negative insight into mathematics, course content of mathematics did not include a sufficient example of applied part of different disciplines, question pattern of mathematics was harder than other subjects.

Moreover, this study concluded that decreasing learners' enrollment was significantly positively correlated with difficulty in subject matters, attitudes of learners, existing exam patterns, and learning environments and is not correlated with the uses of mathematics. This study further found that the learning environment and existing evaluation system were directly influenced by decreasing students' enrollment. There was no significant impact on reducing students' enrollment at a higher level with difficulty in subject matters, the attitude of students, and applications of mathematics.

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Furthermore, the learning environment and actual judgment system play a significant role in enhancing the quality of education. These two independent variables should be managed by doing different research activities to address the student's interests and demands within a short period. The existing judgment system should be updated to raise the pass percentage of students and reduce the difficulty level of question patterns in exams in mathematics. Thus, concerned campuses and universities should frequently manage different types of workshops, training, seminars, and conferences in the applied field of mathematics to improve the learning environment. Also, new learners at a university level should be guided, inspired, and motivated to enroll in mathematics by explaining the importance of mathematics in diverse fields. Faculty members of mathematics should be involved to do different types of research to enhance the scope of mathematics.

In the end, this study unrevealed about the attitude of faculty members, the economic status of learners, job guarantee, and family influence. Some educated people said that mathematics was not applied in real life so the learners did not like mathematics. But this study found the learning environment and evaluation system were the main reasons. The nature of pure mathematics and applied mathematics are different. This study took respondents who were involved either in pure mathematics or applied mathematics or both at Pokhara valley and its surrounding. Further research about the perception of teachers in the enrollment of students in pure mathematics and applied mathematics separately should be done in different places to generalize and validate this result.

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