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Understanding the Factors Affecting the Intention to Adopt Cloud Technology among University Student of Nepal using Technology Acceptance Model

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ABSTRACT
One of the most crucial areas in developing technology-driven human resources is academia. Today, the use of cloud technology is burgeoning worldwide which will soon lead to the fortification of its application in academia as well. To understand the student's perception regarding the adoption of the cloud and the services available through it, a survey-based methodology along with Technology Acceptance Model was taken into account as a research model. n=90 responses were taken into consideration based on 5 points Likert scale and select the best answer among the total number of respondents. Based on statistical hypothesis and feature selection and it was found that among university students who study cloud as an academic course, students were more likely to adopt cloud technology with a P-value of 0.00019. It also shows that cloud-based learning can contribute to the acceptance of cloud technology if cloud education is provided early in the undergraduate program (P-value of 0.0017). On top of that, security and privacy (P-value of 0.00019) are also the factors for choosing the cloud. However, factors such as peer pressure and regulatory policies were excluded from consideration which might also influence cloud technology acceptance.

Keywords:-Technology acceptance model, cloud technology, understanding level on cloud, student cloud adoption

INTRODUCTION
Cloud Computing is the practice of providing computing services over the internet offering flexible resources and scalability. The computing services provided through the cloud include storage, databases, servers, software and many more. The Cloud computing concept was initially drafted many decades back, but in recent years cloud computing has seen growing interest from academic institutions to provide educational content. Cloud computing is widely used in colleges and universities; it helps teachers, students, and administrators in an equal manner and is a development in today's education system. It plays a vital role in the teaching and learning process at any University. Cloud computing services enable virtual access for students to their course contents and assignments and for teachers they can provide leaning materials and assignments provided there is internet access. Students are also able to collaborate on their work, share information through cloud technology which is cost-effective, saves data storage and time. Various problems arise in regards of the use of cloud computing such as the case of confidentiality, the volume of users could be challenging to handle by the server, dependence on network performance, need a human presence to centralize and control overall computation

in any sector of the economy [28].

In Nepal, 88.3% of students were enrolled in bachelor's programs in 2016, and the most popular majors were management (42.2 %, education (24.8 % and humanities and social studies (10.7 % and comparatively low enrollment rates in professional disciplines like medicine or engineering [11]. The data shows that having fewer enrollment rates in engineering disciplines like Information Technology, Computer Science (CS), Computer Science and Information Technology (CSIT), Computer Engineering (CE), there is relatively less domain of students who are potentially exposed to the cloud. It is also seen that research on cloud computing has not been highly utilized in the context of Nepal [22]. With the rise in cloud technology grooming, the paper intended to understand the student perception regarding the adoption of cloud technology in the context of university students of Nepal. This research paper highlights the factors affecting the adoption of cloud computing among university students by a survey based procedure along with the Technology Acceptance Model (TAM). The data was obtained using questionnaires on a five-point Likert scale distributed to the survey participants through social media groups. A total number of 90 participants were filtered out for further analysis using feature selection and statistical hypothesis testing was performed. The survey-based adoption assessment of the Technology Acceptance Model (TAM) shows that cloud-based learning can contribute to education and the acceptance of cloud technology is high if cloud education is provided early in the undergraduate program. Furthermore, this paper contributes to universities in Nepal to focus on providing cloud as course and cloud based learning to the student in the early phase so that they can contribute and become reliable to the industry where

cloud computing and technology is gaining popularity exponentially.

LITERATURE REVIEW
Cloud Based Computing has attracted a lot of interest in the field of education. Learning platforms such as Massive Open Online Course (MOOC) have further cemented the necessity of cloud computing in the education sector, and MOOCs are the future for educational technology [15].
A study conducted to examine the factors leading to adopting cloud computing as a virtual computing lab for a class found that students' ease of use perception would positively affect intentions for future use, but not for actual use [5]. The study also found that students who are not comfortable with new technology had a negative effect on perceived usefulness. Students may not understand the technology behind cloud computing, but they are more likely to accept cloud computing if their perceived ease of use is high [8].

As cloud computing is growing popular and the awareness of the potential that comes with cloud computing has gradually paved its way to university curriculum. The main challenge lies within identifying a suitable and available cloud computing technology that aligns with the course objective [9]. However, it is crucial to understand what factors encourage or discourage students from accepting the course contents before integrating them in the course curriculum. It was found that prior experience, innovativeness, industry, market scope, security and trust, perceived benefits, social influence has a significant impact on cloud adoption [2,17].

Theoretical Framework
The Technology Acceptance Model (TAM) was arose by Davis [10] and based on the theory of reasoned action [12], that aims to explain the relationship between attitude and behaviors within human

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activity and the hypothesis used by him was that the user's attitude towards a new system that would determine whether the user will use the system or not. It has two primary factors that determine the intention to use new technology: Perceived Ease of Use (PEOU) and Perceived Usefulness (PU). PEOU is defined as the extent to which a person believes using a particular system would be effortless. PU is defined as the extent to which a person suspects that using a specific system would boost his/her job performance. TAM explains around 40 percent of the variance of user's behavior in adopting technologies [10,16].
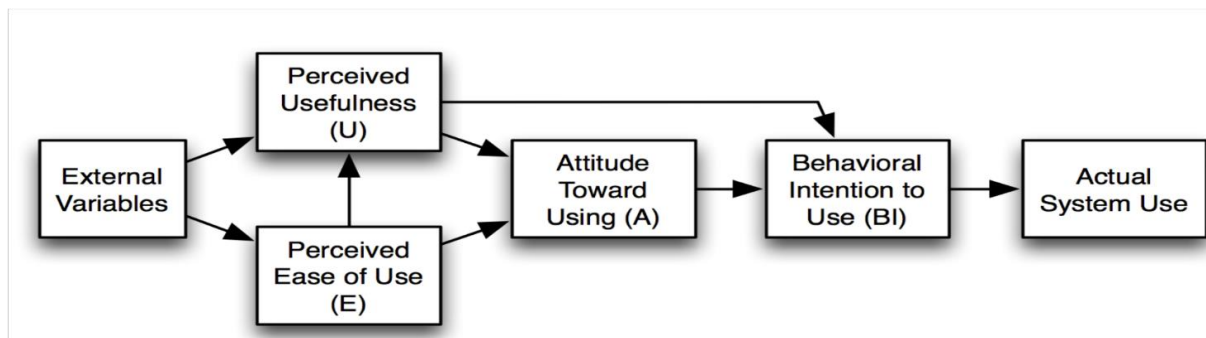
Fig.1:-The Technology Acceptance Model, version 1.

According to Davis, user acceptance is affected by external variables that influence different aspects. A systematic review on eighty-eight TAM studies came into conclusion that including external factors as predictors of perceived ease of use and perceived usefulness which is a notable modification for TAM related studies [19].

HYPOTHESIS
The following hypothesis was taken into consideration using TAM: H1, H3, H5, H7 were null hypothesis, and H2, H4, H6, H8 are the alternative hypothesis.

Hypothesis 1 (H1): Studying clouds as a course offered by university doesn't encourage student to use cloud technology.
Hypothesis 2 (H2): Studying clouds as a course offered by university encourages student to use cloud technology.
Hypothesis 3 (H3): Cloud services focused for the student is not the factor for cloud adoption.
Hypothesis 4 (H4): Cloud services focused for the student is the factor for cloud adoption.
Hypothesis 5 (H5): Security is not a reason for adoption of cloud.
Hypothesis 6 (H6): Security can be a reason for adoption of cloud technology.
Hypothesis 7 (H7): College year of undergraduate's do not support in adoption of cloud.
Hypothesis 8 (H8): College year of undergraduate's support in adoption of cloud.

METHODOLOGY
A question based survey was used to accumulate the data from 200 plus students belonging to the different IT and engineering universities of Nepal. Among 200 plus data, maximum data were unnecessary so on cleaning only 90 out of 200 data were taken further. The questionnaires were framed through a 5-point Likert scale, and some questions were to choose among the best alternatives based on the model of TAM [10]. Two successive rounds of pretesting were conducted to ensure that the respondents could understand the survey questionnaire. The questionnaire was reviewed by the academic professor of Kathmandu University, profound in questionnaire design and cloud technology. Next, the

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survey was then piloted with Cloud experts. Based on the assessment the questionnaires were finally sent to the university computer club and Facebook groups. They were requested to fill the form from Computer Science (CS), Computer Engineering (CE), and Computer Science and Information Technology (CSIT) program's student and the following table describes the demographic information of the participants.

Table 1:-*Demographic information of the participants based on the college program*

Program	Population
CS	46.1%
CE	24.7 %
CSIT	29.3%

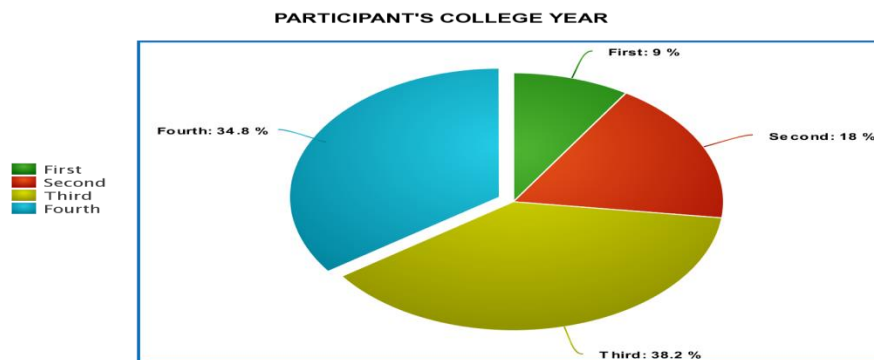The statistical analyses were performed using Python language and its library. For cross-validation of the result, particular action was performed in orange and excel tools. A P-value of less than 0.05 was considered to be statistically significant, with a 95% confidence interval [14,26].

Table 2:-*Demographic information of the participants on the basis of knowledge on Cloud*

Program	Knowledge on Cloud
CS	38.24 %
CE	22.46 %
CSIT	17.97 %

Table 3:-*Gender information of participants*

| Program	Gender	
	Female	**Male**
CS	10	32
CE	5	17
CSIT	15	11
Total	30	60

Fig.2:-*Participant's College year*

The statistical analyses were performed using Python language and its library. For Cross-validation of the result, particular action was performed in orange and excel tools. A P value less than 0.05 was examined statistically significant, with a confidence interval of 95% [14,26].

RESEARCH FRAMEWORK
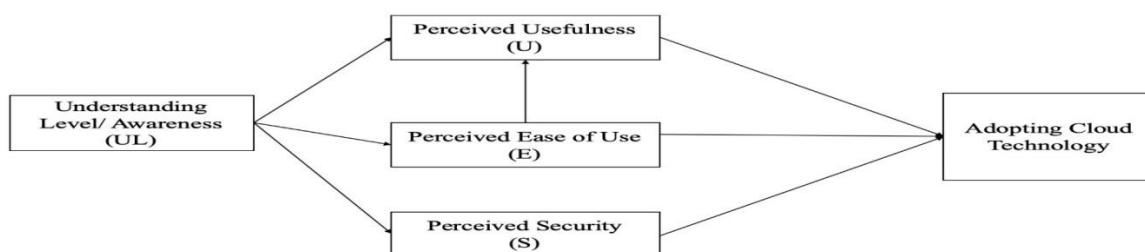
Fig.3:-*Research Model*

The model of research for the paper is presented in the Figure (Figure 3). Literature review shows that numerous scholars have accepted TAM for research purposes [3,4,7,21]. Also, the research model for the paper has been adapted with the TAM model [10] and until and unless there is basic awareness or understanding level of something [23], one can never and ever understand its usefulness, ease or any other factor. Thus, with this ground, the paper has taken Understanding level (UL) as a dependent variable for the adoption of cloud technology and other fourteen questions/attribute as an independent variable, which is given in Table 4.

RESULTS
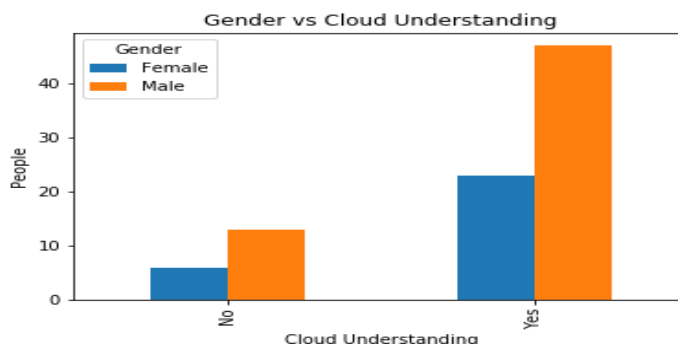
Fig.4:-Gender wise understanding level of Cloud.

Figure 4 shows the cloud understanding level on a gender-wise basis. It was seen that male students have a higher population as well as shows a high degree on an understanding level as compared to females, and also, the difference on both gender wise is almost the same, i.e., there is no much difference in understanding level.
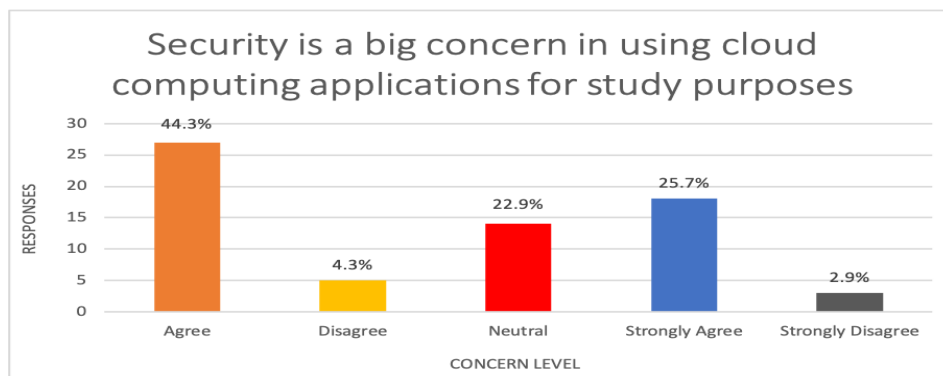
Fig.5:- Security concern and cloud usages

Figure 5 shows that security has been taken as the most significant concern of interest while using the cloud for study purposes. Almost 44.3% of the total, agree with the statement regarding security, and 25.7% strongly agree with the statement. However, it was also found that 4.3% disagree with the statement of security. On performing a statistical hypothesis testing, the paper found that P-value for the statement "security is a big concern in using cloud computing applications for study purposes.", was 0.0006, which is less than alpha; thus, it is statistically significant, and tie up with the alternate hypothesis H6, i.e., security is the reason for the adoption of cloud technology.
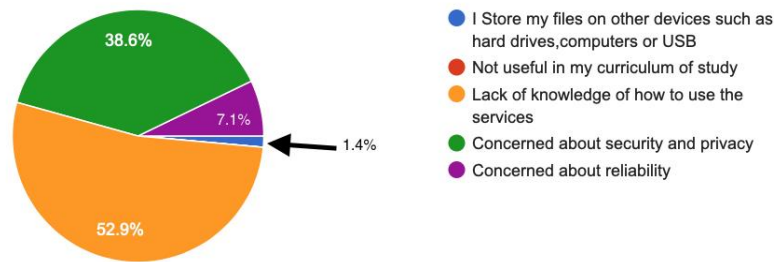
Fig.6:-*Reasons behind not preferring Cloud*

Figure 6 shows that almost 52.9% responded that students do not prefer using cloud technology because of a lack of knowledge of how to use the services provided by cloud service providers. Almost 38.6% responded that due to the concern of security and privacy, students are not using cloud services to their full benefits. It was seen that 1.4% store files on USB drives so they never try to use cloud services and also on performing a statistical hypothesis testing, the paper found that P-value is of the aforementioned statement was 0.0001, which is less than alpha; thus, it is statistically significant, and tie with the alternate hypothesis H2, i.e., Studying clouds as a course offered by university encourages students to use cloud technology.
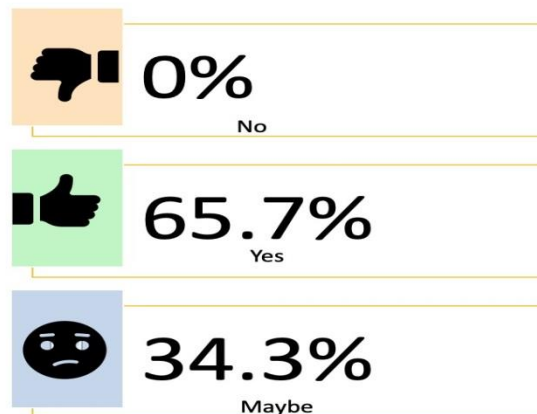
Fig.7:-*Participants response regarding the cloud as a solution offered by the University*

Figure 7 shows that almost 65.7% responded that they are willing to take the cloud services provided by the university, while 34.3% seem to have a dilemma of whether to accept the cloud services offered by their university or not. Interestingly no response was recorded in favor of not taking the cloud solution provided by the university.

Fig.8:- *The extent to which cloud services affect the behavioral engagement of the student.*

Figure 8 shows that almost 48.6% responded that using cloud services to study makes it easier for them to do more real-life applications, followed by 30% are trying to do assignments with the help of cloud services. Interestingly, it was seen that almost 4.3% of people prefer to study by themselves without using any cloud services.
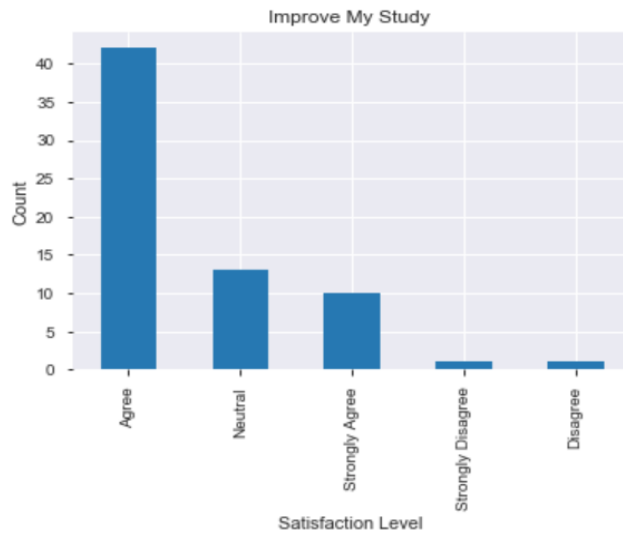
Fig.9:-The extent to which cloud computing improves in studies

Figure 9 shows that most of the population agree that having satisfaction on cloud technology will improve their level of study and performance, and on performing the statistical tests, the paper found a P-value of 0.022, which is less than alpha thus it is statistically significant.

Fig.10:-Facility provided by cloud that helped in studies

Figure 10 shows that 37.1% of people responded that cloud services categorized as productivity, which includes Google Docs, Microsoft Office 365, and Paper by Dropbox, were highly used by students for maintaining performance and support in studies. It was also seen that almost 34.3% of students use cloud services for backup and recovery, which includes services like Dropbox, Google Drive, and sync.com. It was observed that cloud services for communication and social networking are given less preference than productivity services when concerned with performance enhancement in studies. There was no response to the statement:" I do not use any cloud services," which shows that one way or another, students belonging to universities of Nepal use Cloud services.

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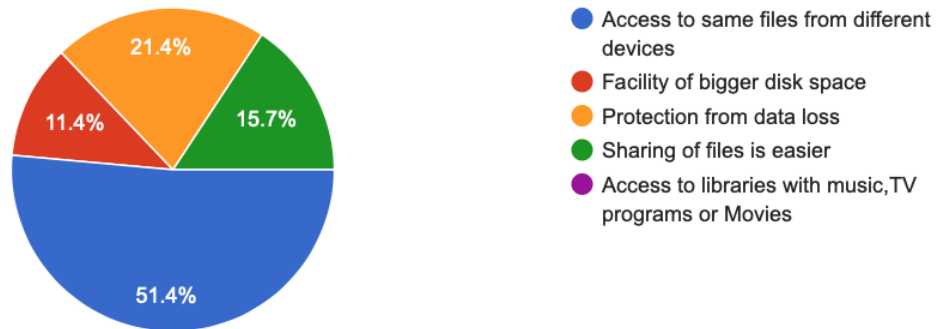
*Fig.11:-Main purpose of using facilities provided by Cloud*

It was seen in Figure 11, that almost 51.4% responded to the prime reason for using the cloud because of the availability of content to access the same files from different locations followed by protection from data loss (21.4%) and finally sharing of data is easier (15.7%). On using SelectKBase and verifying with Extra tree classifier, the paper found that the response for" I rely upon the cloud for technology for study purpose" was highly related to the dependent variable. SelectKBest uses Chi-squared (Chi2) as scoring functions which is operated as an appraisal to assess whether the class label is independent of a particular feature or not [18]. The formula is given below.

$$\tilde{\chi}^2 = \frac{1}{d} \sum_{k=1}^{n} \frac{(O_k - E_k)^2}{E_k}$$

Where O = Observed frequencies, E = Expected frequencies

Chi2 takes as an input of non-negative values, and the dataset is either 0, and 1 and the objective of the paper is to find the features for the adoption of cloud-based on the understanding level, so Chi2 based SelectKBest works best for such type of feature selections [6].
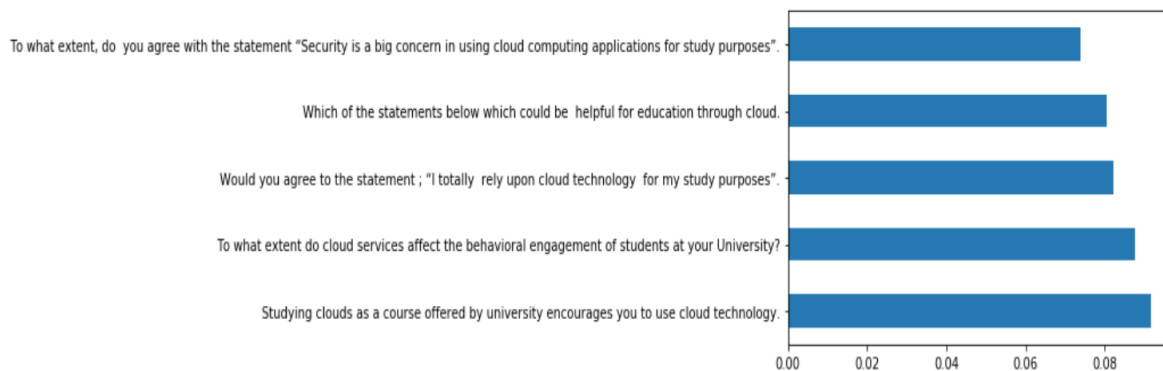
Fig.12:-Top 5 features/ attributes highly dependent for under- standing level.

As the research domain revolves around the educational dataset to further fortify the feature selection process, the paper did cross-validation for feature selection using Extra Trees classifier, also called Extremely Randomized Tree as feature importance, where it randomly select the features and the best split among those is chosen[13]

Using both SelectKBest and Extra Tree classifier, the response for "Studying clouds as a course offered by university encourages you to use cloud technology,"

was found to be a major reason for the adoption of cloud based computing. On performing a statistical hypothesis testing, the paper found that P-value for the statement "Which of the statements below could be helpful for education through the cloud.", was 0.0001, which is less than alpha; thus, it is statistically significant, and tie up to with the alternate hypothesis H2, i.e., Studying clouds as a course offered by university encourages students to use cloud technology.
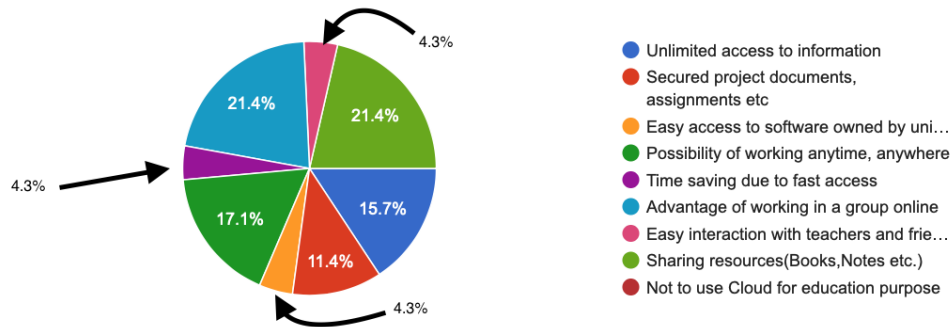
Fig.13:-Usefulness of cloud in student-focused education purpose

The usefulness of cloud technologies is different among different students because everyone prefers using clouds in their way. Figure 13 shows that almost 21.4% responded that sharing resources (Books, Notes) will be the most helpful services for education followed by working from anywhere anytime (17.1%) It was seen that almost 21.4% responded that the advantage of working online is also the helpful step for education through the cloud. Nearly 4.3% responded that time-saving due to fast access, easy interaction with teachers, and easy access to software owned by university provided through the cloud is the reason that could assist education through the cloud. No response was seen to the question of not to use the cloud for education purpose and on performing a statistical hypothesis testing, the paper found that P-value for the statement "Which of the statements below could be helpful for education through the cloud.", was 0.0002, which is less than alpha; thus, it is statistically significant, and chips in with the alternate hypothesis H4, i.e., Cloud services focused for the student is the factor for cloud adoption.
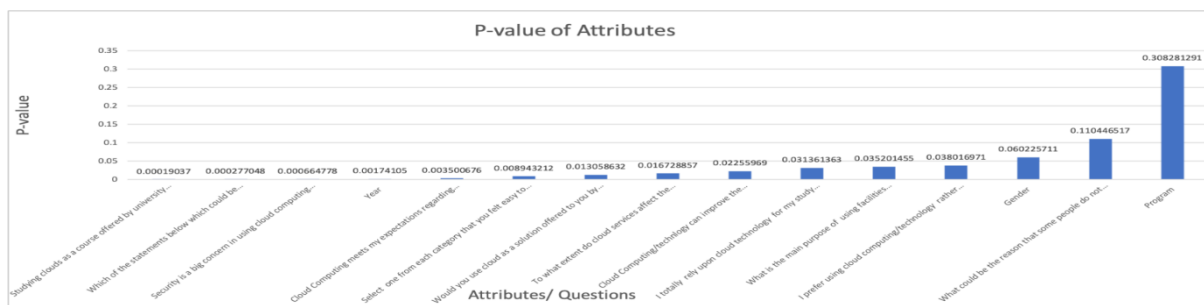
Fig.14:-P-value level of the attribute

The paper found a p-value of each attribute regards to the level of understanding about cloud and shown in Figure 14 and from the list, it was found that the attributes: "Studying clouds as a course offered by university encourages you to use cloud technology, "Which of the statements below which could be helpful for education through the cloud", "Security is a big concern in using cloud computing applications for study purposes" and "Year" were most significant.

Table 4:- P-value of each attribute/question

Program	Knowledge on Cloud
Year	0.001
Program	0.308
Gender	0.060
I totally rely upon cloud technology for my study purposes.	0.031
Which of the statements below which could be helpful for education through the cloud.	0.0002
What could be the reason that some people do not prefer using cloud computing?	0.1104
Security is a big concern in using cloud computing applications for study purposes.	0.0006
I prefer using cloud computing/technology rather than downloading or installing other software for my course material.	0.038
Cloud Computing/technology can improve the productivity and performance of my studies.	0.022
Cloud Computing meets my expectations regarding the ease of use.	0.003
To what extent do cloud services affect the behavioral engagement of students at your University?	0.016
Studying clouds as a course offered by the university encourages you to use cloud technology.	0.0001
What is the main purpose of using facilities provided by the Cloud?	0.035
Would you use the cloud as a solution offered to you by the University?	0.013
Select one from each category that you felt easy to use and support in your study.	0.008

The above table shows the P-value of each independent attribute with the dependent attribute: Understanding Level and paper found that the college year is also the factor for the adoption of cloud technology. On performing a statistical hypothesis testing, the paper found that P-value for the statement "Year," was 0.001, which is less than alpha; thus, it is statistically significant, and chips in with the alternate hypothesis

H8, i.e., College year support in the adoption of cloud.

DISCUSSION AND CONCLUSION
Discussion
Unless and until there is a basic awareness or understanding level of something [23], one can never and ever understand its usefulness, ease, or any other factor. Therefore, the paper has taken Understanding level (UL) as a dependent variable for the adoption of cloud technology. Among the studied population, almost 18 % didn't have knowledge about cloud technology. Thus, lack of awareness is a factor affecting the adoption of cloud technology, which validates with the study of [25].

Security and privacy are the primary concerns for cloud adopters because valuable data reside outside the institutions' firewalls. Therefore any hacking or other forms of attack on the cloud vendor's infrastructure will affect all student's assignment, books, program and even institute critical documents [20] and agrees with the study of [1,24] thus maintaining the security of the cloud and assuring the student about the privacy concern about cloud technology will enable the greater adoption of the cloud. As the study of [8] highlighted that students who are not comfortable with new technology had a negative effect on perceived usefulness and further, though students may not understand the technology behind cloud computing, but they are more likely to accept cloud computing if their perceived ease of use is high and taking the course of cloud on early phase might give student the confidence of understanding the perceived ease of use and the paper found that studying clouds as a course offered by university encourages the student to use cloud technology and enables them to enhance self-efficacy on cloud technology. In the various universities of Nepal,

students have to do a course-based project, and studying cloud shows that they are adopting cloud based technologies in the early phase, thus leading to cloud adoption.

Conclusions

The research concludes that studying clouds as a course offered by the university encourages students to adopt cloud and cloud based technology. While doing this, security and privacy are also factors for choosing the cloud. So, any cloud based product development company like Zoom, google should always keep priority to privacy and security as top priority in order to attract students as customers. Further the paper also concludes that the college year is also the major factor for cloud adoption. The result shows that fourth-year students were seen having more understanding levels compared to other levels of the student and offering cloud courses in the first year only would drastically enhance the cloud technology adoption rate in a university level. The research advocates universities in Nepal to adopt cloud computing as a course in early phase (i.e. first year of the study).

Nonetheless, these results must be interpreted with caution, and a number of limitations should be borne in mind. As the data set consists of 90 instances, only the result might get changed on increasing the sample size for a result with better predictions. The paper was not able to include a number of factors that have been shown to influence technology acceptance, for example: peer-pressure, Regulatory policies [27]. The research was conducted in some of the university students only, which may limit the generalizability of the findings. The few challenges that are likely to be experienced can be resolved by better policies and techniques. University can develop a robust course module and introducing a cloud course in first-year can

lead to more adoption of cloud technology. As cloud technology/computing is a still new technology for education purposes, further studies in this domain would help academia and industry to understand the benefits, weaknesses, and challenges of adopting this technology for meeting better results.

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