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# Navigating Remote Learning: A study on Student Perceptions During Times of Uncertainty

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**ABSTRACT:** Covid 19 pandemic impacted the global economy, operations and people daily lives. The pandemic has a ripple effect on student learning which in turn will impact global economy for years to come. As the Covid-19 pandemic forces educational institutions in several countries to transition from face-to-face instruction to emergency remote teaching, teachers and students face the daunting task of adapting their practices. This research investigated university student attitude toward learning from home while focusing on the Omani context. In addition, it is aspired to understand and analyze different factors affecting student attitudes toward remote learning including demographic factors, technology access, technology competencies, learning preference and technology usefulness. The study was conducted using an online remote learning pedagogy questionnaire designed using a five-point Likert scale. A total of 279 students participated in this study from various study levels. The study findings highlighted important elements that should be addressed by educational institutes when offering a remote learning experience. Firstly, student-teacher engagement is an essential part of remote learning. The ability for students to communicate seamlessly with their facilitator is a critical factor in promoting positive attitudes toward the remote learning process. Secondly, technology accessibility impact student's perceptions and attitudes toward remote learning. Reliable and seamless access to the university learning platforms and online resources are critical success factor. Finally, offering students a variety of online learning resources activities and interactive materials can impact student satisfaction. Other factors influencing students' attitudes toward remote learning includes previous online experience, online support services, access to technical support, collaboration, and digital curriculum design.

**Keywords:** COVID-19, Higher education, emergency remote teaching, Oman, online learning, student attitudes, factors, TAM.

## I. INTRODUCTION

The COVID-19 pandemic impacted the global economy and operations of various sectors worldwide including healthcare and education [1, 2]. The educational sector had a major direct impact. Educational institutes are on the rush to find alternative teaching solutions to overcome this dilemma. Fortunately, with austerity opportunities and innovations arise. Clearly, COVID-19 has given remote learning a huge boost. Many educational institutes are forced to use technological solutions to offer students the opportunity to continue their education from home. Remote learning is defined as the ability for educational institutes to deliver their teaching and learning capabilities to students remotely anywhere at any time using technological infrastructure. The technological infrastructure includes Internet, cloud services, learning management platforms, collaboration and communication platforms, virtual labs, and digital curriculum designs. In addition, AI and machine learning is revolutionizing our daily life. It has been applied in a wide range of

applications including public health [3], smart sensing [4], security [5], environment monitoring [6]. Thus, the utilization of new technology advancement in AI and machine learning in education is an important aspect to consider when deploying online learning strategy. Beside the utilization of technology advancement, it is important to take into consideration various aspect of student interest in the learning process including assessments, feedback, course design, course content, and performance monitoring [7, 8].

After COVID-19 continues to spread, educational institutes are embracing remote learning technologies. Therefore, it is imperative to investigate students' attitudes and acceptance toward a new way of teaching. Surely, the rapid deployment of new teaching and learning strategies and methods will be faced with obstacles and challenges. However, these challenges and obstacles can be eradicated with proper analysis, planning, and cooperation with all related parties. Universities across the globe have decided to shift its teaching and learning using remote learning strategy. Therefore, this study aims to investigate and identify factors influencing university students' perceptions and attitudes toward remote learning in the presence of COVID-19 pandemic.

This paper is organized as follow. First, a literature review and hypothesis formulation are presented. Second, the study research questions are highlighted. Thirdly, research design and methodology are discussed in details. This section includes environment settings, survey details, ethics and reliability analysis. Next, the results of this study are presented and discussed. Finally, the study is concluded with summary and recommendations.

## II. THEORTICAL BACKGROUND AND FRAMEWORK

China, the first country to be subjected to the Covid-19 pandemic, launched the "School's Out, But Class's On" campaign to respond to the new situation [9]. However, e-Learning was not the norm in China [10] and teachers copied their face-to-face material directly to the online platforms resulting in unsatisfactory autonomous learning. Responses to national transitions varied by countries, with France deploying the already existing CNED system or Georgia using the G Suite on a national scale [11]. Educational institutes across the globe are forced to find alternative means and solutions to deliver knowledge and education to students remotely [40, 41, 42]. The only way to address this issue is through adapting technological solutions to enable remote learning. It is well known that technology dissemination and adaptation can be challenging and complex. Introducing new way of teaching by enabling remote learning through technologies can face resistance and acceptance issues. Therefore, studying students' perceptions and attitudes toward remote learning is an important aspect in any successful remote learning situation. In order to understand student's intentions and attitudes toward remote learning, we have reviewed various theories related to technology adoption and acceptance. Some of the notable theories are; The Technology Acceptance Model [12], The Unified Theory of Acceptance and Use of Technology Model [13, 14], Innovation Diffusion Theory [15], The Theory of reasoned Action [16]. In this study, five main factors have been adapted based on established theories and models. In the following sections we discuss the theories related to the selected five factors:

### *1. PERCEPTION AND ATTITUDES*

One of the influential theories of human behaviour is the Theory of Reasoned Action (TRA) proposed by Fishbein and Ajzen in 1975 [13, 14]. It has been used widely to analyse and predict a wide range of human behaviours. Various studies have used TRA to analyse and explain how human attitudes and beliefs are related to individual intentions to perform an action. In TRA, a person intention toward an action plays a decisive role in deciding if a person will perform such action or not. Consequently, to predict intentions two factors are used; the attitudes and subjective norms. TRA assumed volitional control, which means individuals are able to execute an action whenever they want to. However, in many cases, this condition can be violated. For instance, a person will not be able to engage in a remote learning scenario without the existence of internet access or online platforms. Therefore, Ajzen (1991) [17], introduced the Theory of Planned Behavior (TPB) by adding a perceived behavioural control component to TRA. The idea is to generalize TRA by incorporating a third factor related to people's perceptions about their experience, skills and abilities to perform an action. TBP has been used widely to study users acceptance of new technologies. Building upon TRA and TPB theory, Davis has formulated the Technology Acceptance Model in 1989 [12].

This model attempt to predict people's behaviours and intentions in accepting new technologies. According to TAM, Behavioral Intention (BI) is determined by individual attitude toward a specific behaviour. This attitude can be determined by two main factors. The first factor is the perceived usefulness (PU) and the second factor is the perceived ease of use (PEOU). So the internal factors used in TAM are the perceived ease of use, perceived usefulness, attitude toward use and behavioural intention to use as shown in Figure 1 .

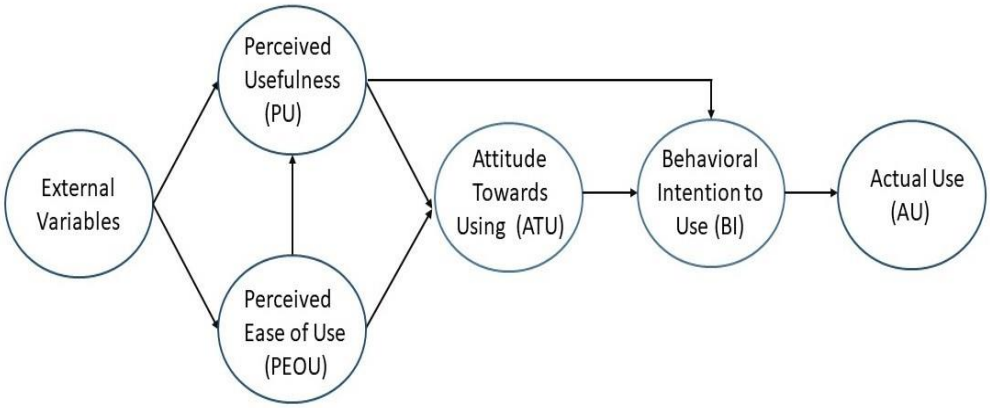


FIGURE 1. Technology Acceptance Model (TAM). adapted from Davis (1989), [12].

## *2. PERCEIVED USEFULNESS AND SATISFACTION*

According to Davis (1989), [12], the perceptions of technology vary between people and it is based on individual intentions and experiences. The Technology Acceptance Model (TAM), emphases on technology usability and ease of use (Davis F., 1989), [12]. According to the TAM model, the attitude toward using technology is based on the perceived usefulness and ease of use. An important internal variable in the TAM model is the perceived usefulness (Davis F., 1989), [12]. This variable measures the perceived personnel belief about the usefulness of a specific technology. In this study, we capture the student's perceived beliefs about the usefulness of their remote learning experience in the presence of COVID-19. According to TAM, the perceived usefulness is affected by a person perception about the system. This means if a person thinks the remote learning is easy to use, they will perceive the remote learning as useful for them. The relationship between perceived ease of use and perceived usefulness has been studied greatly and shown to be an important factor [12, 18, 19].

## *3. TECHNOLOGY COMPETENCY/EXPPERIENCE*

One According to the literature, an important factor influencing student's attitude toward remote learning is their technology competency and their previous e-learning experience. Technology competency and previous experience have been found to influence TAM components such as perceived usefulness and the perceived ease of use [20, 21]. Furthermore, various literature addresses the importance of individuals' competency and computer self-efficacy on their abilities to perform technological tasks [18, 22]. Recent studies demonstrated the influence of self-efficacy in reducing personnel anxiety when using the learning management system [23, 24]. Therefore, students' self-efficacy, technology competency and experience will influence students' perceptions, satisfaction and attitudes toward remote learning. The remote learning experience demands a wide range of technical experience and skills. Students are expected to be able to use various technologies including the internet, internet technologies, communication systems, digital contents and educational platforms. Therefore, in this study, we consider students technology competency and experience as another factor influencing their perceptions and attitudes toward remote learning.

*4. LEARNING PREFERNCE*

Learning preferences play an important role in providing students with high-quality remote learning experience. It can influence student's perceptions and attitude toward remote learning. Providing a variety of learning tools and methods is critical. Research has shown the positive impact of providing a variety of learning instructions to students [25, 26]. Various studies have shown the influence of student learning preference in their attitude toward remote learning. Therefore, it is worth investigating the importance of student learning preference in a remote learning setting [27, 28].

*5. ACCESS TO TECHNOLOGY*

An essential component in any remote learning technology is accessibility. The ability for students to accesses educational institutes' online services is tightly coupled with internet and technology accessibility [29]. Accessibility is about the ability of users to access online services anywhere at any time and with ease. It includes access speed, network reliability, system availability, and ability to access online services from any computing platform.

## III. RESEARCH QUESTIONS

This research paper attempt to investigate student attitude and perception toward remote learning during COVID-19. After analyzing and reviewing previous research, we identified several important research questions related to students' attitudes and technology acceptance for remote learning. The research questions are as follow:

- RQ 1: What are the overall student attitudes and perceptions toward emergency remote learning in the presence of COVID-19 pandemic?
- RQ 2: What is the relationship between technology access and other factors?
- RQ 3: Does internet use time influence student attitude toward remote learning in the presence of COVID-19 pandemic?
- RQ 4: Does students learning preference influence their attitudes toward remote learning? RQ 5: Which method of learning is preferred by students in a remote learning scenario?
- RQ 6: Is there any significant difference in student perceptions and attitude toward remote learning between different Levels?

## IV. RESEARCH DESIGN AND METHODS

*1. ENVIRONMENT AND SETTINGS*

In the presence of COVID-19 institutions around the globe are forced to offer a remote learning experience for their students. Prior COVID-19, remote learning programs have minimal contribution to Oman's higher education sector. Many universities conduct most of the teaching face to face and requires students to attend classes on the campus. Since the beginning of COVID-19 local educational institutes have taken tremendous actions to offer their students the best possible education experience via remote learning. The new learning experience was conducted online using various technologies including Learning Management System (SULMS), MicrosoftTeams, emails, online library services, digital interactive materials and other means of teaching. It is worth noting that all curriculums and assessments offered by the university have been redesigned to suit the new COVID-19 remote learning experience. English is the main language of teaching in most facilities, however in some faculties, Arabic is the main language.

*2. SURVEY DESIGN*

An online remote learning pedagogy questionnaire (RLPQ) was designed using a five-point Likert scale (strongly agree, agree, neutral, disagree and strongly disagree) to capture various factor related to students remote learning experience during COVID19 pandemic. Participants were asked to indicate their level of agreement for seventeen statements using a rating scale from "1" 'strongly disagree' to "5" 'strongly agree'.

The seventeen statements are designed to address different factors including student perceptions attitude, perceived usefulness, technology competency experience, and learning preference. Beside the five-point Likert scale other questions were included to capture participant's demographic data and access to technologies. The access to technology section consists of seven statements with a different type of questions ranging from two options (Yes/No) to multi-scale options. For instance, in one of the questions students were asked to indicate their level of access outside the university. The options provided were:" No access", "Poor", "Medium" and" Good access".

### *3. PROCEDURE*

The study was granted ethical approval by the Sohar University Ethics and Biosafety Committee. The survey was conducted online anonymously. No identifiable information has been collected from the participant. Participation in this study was voluntary. All participants have been provided with a consent form before starting the survey. The consent form includes author contact information, the purpose of this study, and the right to withdraw from participation.

### *4. PARTICIPANTS*

The This research was conducted during the COVID-19 pandemic in 2020. The participants of this research are from students enrolled in a higher educational institute in the Sultanate of Oman. The survey was distributed online to undergraduate students from Level 1- Level 4. Level 1 indicates that the students are in their first year while Level 4 indicates that students are in their fourth year. We sampled students from a different level of studies (L1-L4). To ensure that only students from a specific level will answer the survey we divided our survey into four phases. In the first phase, we disseminated the survey to Level 1 students and received 59 responses. After that, we disseminated the survey to students from L2-L4 consequently (See Table 1). The survey was distributed randomly to all students using online channels ((i.e., via social media or email). In total 279 students participated in this survey with a response rate of 98.2%. Note that the total number of students in FCIT is approximately 900 students therefore our survey captures more than 31% of the FCIT population. This is considered a strong sample size with a confidence interval of ±3% at the faculty level and ±6% confidence interval at the university level (Denscombe, M, 2014, p. 57). Since most of the enrolled students are females, the participants Female to Male ratio is 3.5 to 1 (see Table 2).

**Table 1.** Student's distribution across levels.

| Level | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Level 1 | 59 | 21.5 | 21.5 | 21.5 |
| Level 2 | 77 | 28.1 | 28.1 | 49.6 |
| Level 3 | 104 | 38.0 | 38.0 | 87.6 |
| Level 4 | 34 | 12.4 | 12.4 | 100.0 |
| Total | 274 | 100 | 100 | |

**Table 2.** Gender distribution.

| Gender | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|---|---|---|---|
| Female | 218 | 79.6 | 79.6 | 79.6 |
| Male | 56 | 20.4 | 20.4 | 100 |
| Total | 274 | 100 | 100 | |

**Table 3.** Survey demographics.

| Survey data description and demographics | |
|---|---|
| **Total Participants** | 279 |
| **Gender** | |
| **Male** | 62 |
| **Female** | 217 |
| **Level** | |
| **L1** | 59 |
| **L2** | 77 |
| **L3** | 32 |
| **L4** | 41 |

## V. DATA ANALYSIS

### *1. DATA DESCRIPTION AND DEMOGRAPHICS*

This Data for this study was conducted online and disseminated to students. The survey was disseminated during the COVID-19 pandemic. It was provided to students at the end of the semester to ensure they immersed themselves with the new remote learning experience. The total number of participants in this survey is 276 from different levels. All participants are undergraduate students from different levels (L1-L4). Table 3 provides a summary of the survey participants and demographics information 3.

### *2. DATA RELIABILITY ANALYSIS*

The collected data was pre-processed then analyzed using excel and SPSS software. Cronbach's Alpha analysis was conducted to analyses the reliability of the selected factors. The reliability test showed that all selected factors achieved an Alpha value greater than 0.7 (see Table 4. An Alpha value greater than 0.6 indicates an adequate level of inter-item reliability [30].

**Table 4.** Cronbach Alpha test results with other descriptive statistics.

| Factors | Items | N | Mean | Std. Dev | $\alpha$ |
|---|---|---|---|---|---|
| Technology Access | 2 | 271 | 2.785 | 0.7485 | 0.733 |
| Perceptions and Attitudes | 4 | 271 | 3.096 | 1.8 | 0.869 |
| Technology Competence | 2 | 271 | 3.155 | 1.0995 | 0.702 |
| Learning Experience and Satisfaction | 4 | 271 | 3.425 | 1.1605 | 0.791 |
| Learning Preference | 4 | 271 | 3.15 | 1.2125 | 0.769 |

The KMO and Barlett's demonstrate that the correlation matrix between different factors is significant. The KMO test shows a value greater than 0.5 indicating that our sample size is adequate. The Bartlett's Bartlett's test of sphericity is statistically Signiant with a P-value ¡ 0.001 (see Table 5).

**Table 5.** KMO and Barlett's test of sphericity.

| | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | 0.908 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 2566.703 |
| | df | 153 |
| | Sig. | 0 |

*3. EXPLORATORY FACTOR ANALYSIS*

Exploratory factor analysis (EFA) in combination with principal component analysis (PCA) was utilized to investigate the structure and relationships between various factors. SPSS was used to extract factors using EFA method with an oblique varimax rotation(promax). The findings indicated that all 17 items had factor loading ranging from 0.51 to 0.94. From the communality's statistics, the lowest communality value achieved was 0.59. Therefore, no component requires elimination. Table 6 shows, eigenvalue for various factor. Factors are selected according eigenvalue criterion, Scree-Test and cumulative variance greater than 70% [31]. In addition, Parallel analysis was used to confirm the selected factors [32].

**Table 6:** Total Variance explained by different component.

**Total Variance Explained**

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Total** | **% of Variance** | **Cumulative %** | **Total** | **% of Variance** | **Cumulative%** | **Total** | **% of Variance** | **Cumulative %** |
| 1 | 6.463 | 43.089 | 43.089 | 6.463 | 43.089 | 43.089 | 3.155 | 21.036 | 21.036 |
| 2 | 1.284 | 8.557 | 51.646 | 1.284 | 8.557 | 51.646 | 2.934 | 19.562 | 40.597 |
| 3 | 1.138 | 7.587 | 59.233 | 1.138 | 7.587 | 59.233 | 1.623 | 10.819 | 51.416 |
| 4 | 1.034 | 6.894 | 66.127 | 1.034 | 6.894 | 66.127 | 1.374 | 9.159 | 60.575 |
| 5 | .907 | 6.043 | 72.170 | .907 | 6.043 | 72.170 | 1.367 | 9.113 | 69.688 |
| 6 | .735 | 4.898 | 77.069 | .735 | 4.898 | 77.069 | 1.107 | 7.380 | 77.069 |

Extraction Method: Principal Component Analysis.

One of the most precise techniques used for the identification of variables or components to retain is parallel analysis. From Figure 1, we can see that 6 factors are significant.

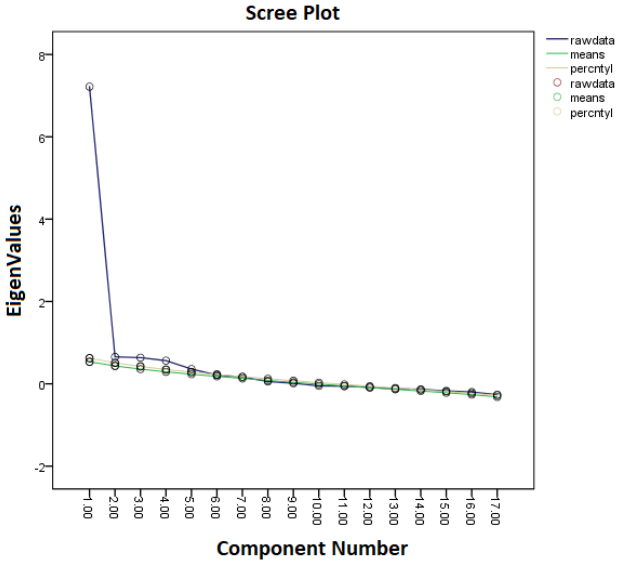


FIGURE 2. Technology Loadings with the parallel analysis and the varimax rotation.

## VI. RESEARCH FINDINGS AND DISCUSSION

**RQ 1:** What are the overall student attitudes and perceptions toward emergency remote learning in the presence of COVID-19 pandemic?

Students were asked questions about their attitudes and perceptions toward remote learning. As indicated in Table 7 Student attitudes toward remote learning ($n$ = 271), 42.9% of students enjoyed their new remote learning experience (*Mean* ≈ 2.19, *SD* ≈ 0.795). In addition, 46.4% of participants agreed that remote learning is convenient for them (*Mean* ≈ 2.179, *SD* ≈ 0.8478). It gives them the chance to work at their own pace and set their own schedule. However, the majority of students (61.1%) find their new remote learning experience hard and challenging (*Mean* ≈ 2.485, *SD* ≈ 0.796). This could be attributed to many factors including the difficulties to adapt to the new learning environment. Furthermore, student-teacher engagement can be another factor, extracurricular activities, university social life, student support services and other factors. Furthermore, from our correlation analysis, we can see that students how does not enjoy working from home find their new experience hard and challenging, $r(271) \approx -0.315, p < 0.01$. Hence they don't want to be engaged in a remote learning experience in the future, $r(271) \approx -0.247, p < 0.01$.

Interestingly, a negative correlation was apparent between students learning enjoyment subscale and teacher communication subscale, $r(271) \approx -0.230, p < 0.01$. This indicates that students who enjoy learning from home and show positive attitudes find it difficult to communicate remotely with their teachers. Contrary to expectations, it was found that there is a negative correlation between student attitudes toward remote learning and the difficulty of remote learning. The Pearson correlation coefficient shows this negative correlation with a statistical significance, $r(271) \approx -0.315, p < 0.01$.

With statistical confidence, we can conclude that students who enjoy remote learning, have a good experience in learning and prefer to study remotely in the future find the remote learning experience hard and challenging. We believe the difficulty appears because the engagement between teacher and students in remote learning can be fuzzy and challenging. Therefore, strengthening the student-teacher engagement in remote learning can make the remote learning process easier and effective for the students especially the one who enjoyed this experience.

**Table 7.** Student attitudes toward remote learning (n=271).

| | Mean | SD | Agree | Neutral | Disagree |
|---|---|---|---|---|---|
| I enjoyed learning from home. | 2.1905 | 0.79543 | 42.90% | 33.20% | 23.80% |
| I believe the major benefit is convenience. | 2.1788 | 0.84783 | 46.40% | 25.20% | 28.50% |
| I believe remote learning hard and challenging. | 2.4852 | 0.70958 | 61.10% | 26.30% | 12.60% |
| I prefer to learn from home in the future. | 1.9926 | 0.84606 | 35.30% | 28.70% | 36.00% |

**RQ 2:** What is the relationship between technology access and other factors?

To address this research question, we examine and analyses different factors. The first factor is related to internet technology accessibility and students' technology competency and experience. The indicators used in the technology access are related to internet access, internet access time, availability of essential software's, access to university learning management system and availability of access devices (smartphones, laptops, and tablets). On the other hand, the technology competency category includes indicators such as confidence in using technology, experience and working environment. Correlation and a statistical analysis were carried out using Pearson correlation as shown in Table 8. From this analysis we can conclude that having a reliable and accessible university learning management system has a moderate positive correlation with students' attitudes toward remote learning, their technical competence, learning preference and satisfaction, ($rAttitude(271) \approx 0.266, rCompetency(271) \approx 0.396, rPerference(271) \approx 0.272, rUsefulness(271) \approx 0.238$).This finding conforms with many published research which emphasizes the importance of LMS systems, and overall system reliability and accessibility [29, 31, 32]. Internet access, system accessibility, ease of use, system quality and technical support plays a significant role in student's satisfaction and their perception toward

remote learning as shown in past research as well [12, 33]. Therefore, it is critical for academic institutes to consider these aspects when deciding to offer a remote learning experience to their students.

**RQ 3:** Does internet use time influence student attitude toward remote learning in the presence of COVID-19 pandemic?

Investigating student's internet use time and remote learning enjoyment is significant. From the results we can see that high internet use time is not associated with positive attitude toward remote learning. Across all levels, more than 53% of the participants indicated that they use the internet for more than 4 hours per day (see Figure 3). However, it is clear that 13.6% of level one students use the internet for less than 1 hour per day compared to only 2.9% per day for level four students. This study shows that, internet usage has no correlation with technology competency or student's satisfactions toward remote learning. However, as indicated in Figure 4, internet use time has negative correlation with student's learning preference. These findings comply with other findings in the literature. As shown in 4, participants who uses the internet more than four hours per day indicates that they do not enjoy the remote learning teaching style (reading materials online, flipped class rooms, lessening to recording, or using instance messaging tools).

**Table 8.** Pearson Correlation test for various factors including Learning Preference (LP), Technology Access (TA), Attitudes Perceptions (AP), Technology Competence (TA), Perceived Usefulness (PU) (N=270).

| | | Learning Preference | Technology Access | Attitudes & Perceptions | Technology Competence | Perceived Usefulness |
|---|---|---|---|---|---|---|
| LP | *r* | 1 | .272** | .656** | .607** | .717** |
| | Sig. (2-tailed) | | 0 | 0 | 0 | 0 |
| | N | 271 | 271 | 270 | 270 | 270 |
| TA | *r* | .272** | 1 | .266** | .396** | .238** |
| | Sig. (2-tailed) | 0 | | 0 | 0 | 0 |
| | N | 271 | 274 | 271 | 271 | 271 |
| AP | *r* | .656** | .266** | 1 | .681** | .754** |
| | Sig. (2-tailed) | 0 | 0 | | 0 | 0 |
| | N | 270 | 271 | 271 | 270 | 270 |
| TC | *r* | .607** | .396** | .681** | 1 | .764** |
| | Sig. (2-tailed) | 0 | 0 | 0 | | 0 |
| | N | 270 | 271 | 270 | 271 | 270 |
| PU | Pearson Correlation | .717** | .238** | .754** | .764** | 1 |
| | Sig. (2-tailed) | 0 | 0 | 0 | 0 | |
| | N | 270 | 271 | 270 | 270 | 271 |

[1]**. Correlation is significant at the 0.01 level (2-tailed).

Internet experience and usage is not associated with positive attitudes toward remote Learning [34]. Research studies has shown that excessive internet usage can have an adverse effect in students learning

performance and intentions [35]. It has been associated with poor academic performance and low intentions toward remote learning [36, 37]. Our study shows that internet usage has no correlation with technology competency or student's satisfactions toward remote learning. However, as indicated above, internet use time has negative correlation with student's learning preference. Our findings comply with other findings in the literature. 72% of the participants who use the internet more than 4 hours per day state that they don't prefer to watch the recorded video lessons. As shown in Figure 3, participants who uses the internet more than four hours per day don't enjoy the remote learning teaching style (reading materials online, flipped class rooms, lessening to recording, or using instance messaging tools).

**RQ 4:** Does learning preference influence student's attitudes toward remote learning?

By analyzing Table 8, we can conclude with strong statistical confidence the existing of a positive relationship between student technology competencies and their learning preference, $r(271) \approx 0.607, p < 0.01$. This suggests that students who are technically competent and with good experience prefer the new remote learning methods such as flipped classrooms, online collaboration, and communicating through instant messaging platforms.

**RQ 5:** Which method of learning is preferred by students in a remote learning scenario?

As demonstrated in Figure 5, more than half of the students stated that they prefer listening to the recorded lessons. While 21% of the students indicated that they don't prefer recorded lessons. Only 36% of the students say they enjoy reading the online materials while 33.95% state that they don't like the reading materials. Overall, we can conclude that students prefer having variety of learning resources and methods. Therefore, it is not advisable to stick to only single way of teaching. Offering students flipped class room, reading materials, recorded lessons, instant messaging, and live streaming through zoom, MsTeams or any alternative live communication platform is essential.

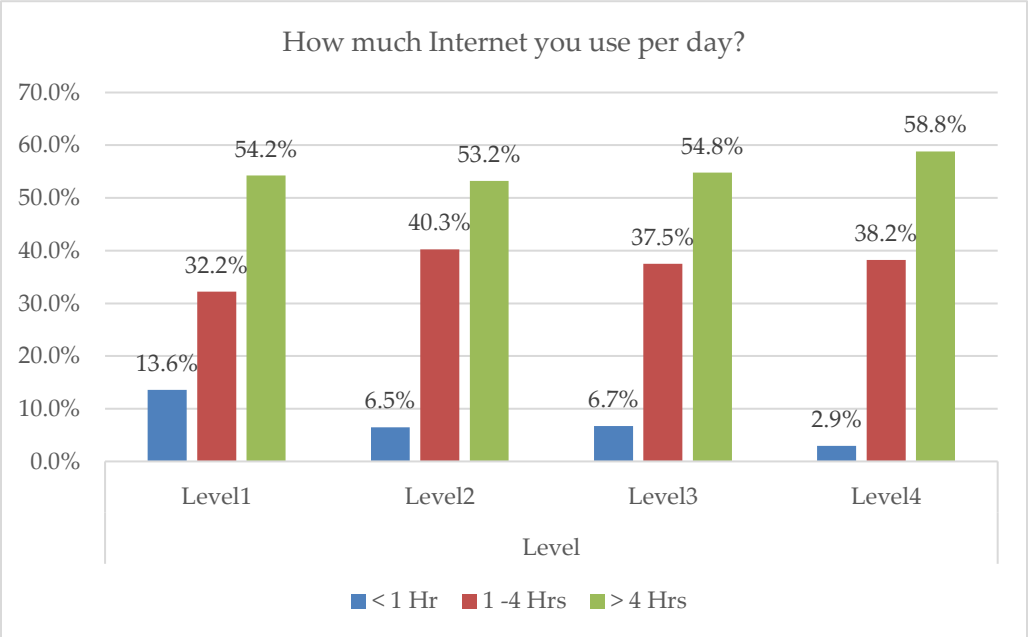


FIGURE 3. Students' internet usage per level (N=271).

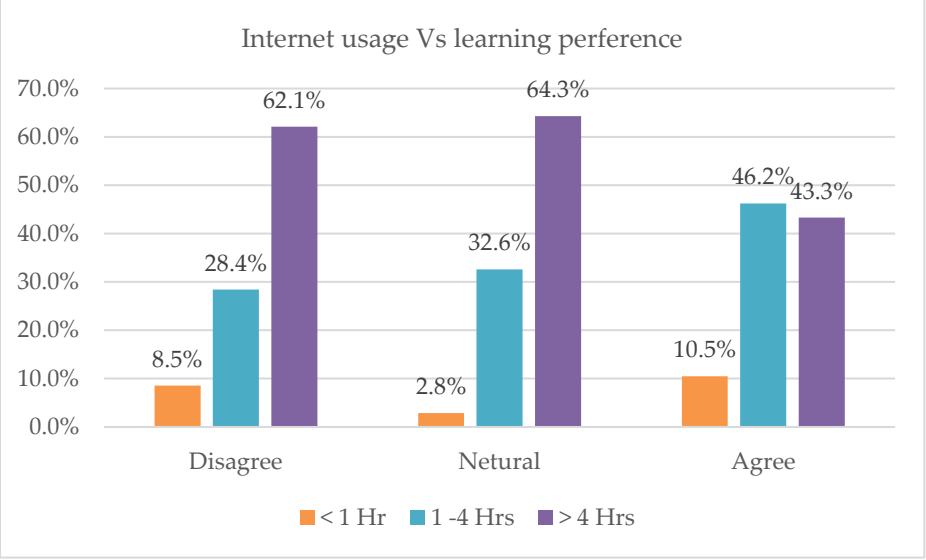


FIGURE 4. Internet usage percentage Vs learning preference (N=271).

**RQ 6:** Is there any significant difference in student perceptions and attitude toward remote learning between different Levels?

The analysis indicates a minor positive correlation between student level and their satisfaction with the remote learning experience. This could be due to the fact that students at a higher level are more independent and autonomous with good experience in learning, $r(271) \approx 0.147, p < 0.05$. Furthermore, a positive correlation between the student level and the availability of laptops and the software required for learning. This indicates that students at the entry level could have difficulties acquiring or installing the necessary tools for the course, $r(271) \approx 0.259, p < 0.01$.

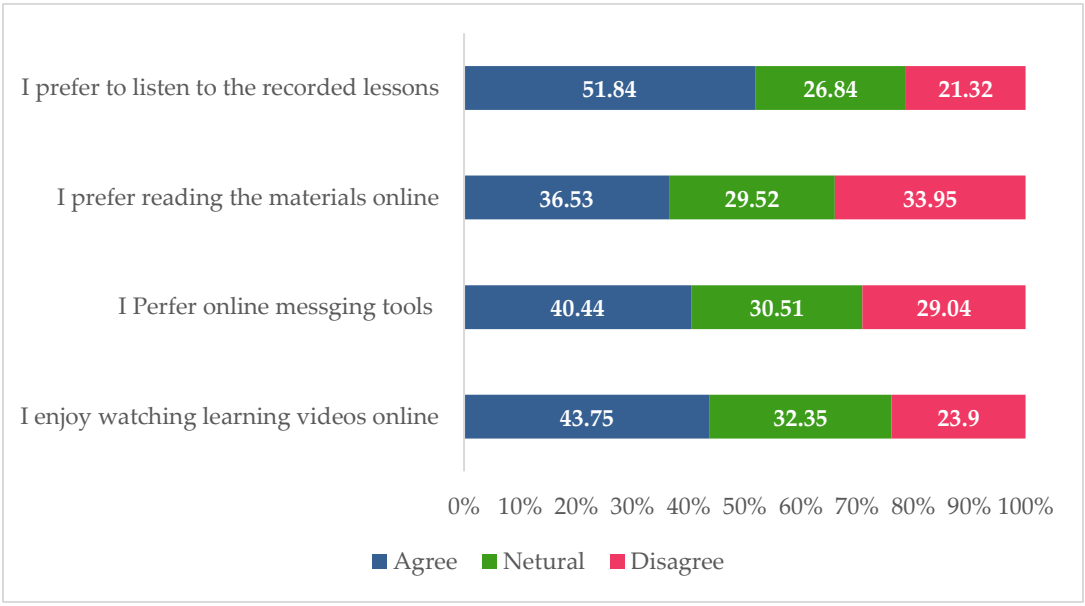


FIGURE 5. Internet usage percentage Vs learning preference (N=271).

## VII. CONCLUSION

From this study, we can summarize some important elements that should be addressed by educational institutes when offering a remote learning experience for their students. Firstly, student-teacher engagement is an essential part of remote learning. The ability for students to communicate seamlessly with their facilitator is a critical factor in promoting positive attitudes toward the remote learning process. Secondly, technology accessibility impact student's perceptions and attitudes toward remote learning. Reliable and seamless access to the university learning platforms and online resources are critical success factor. Thirdly, offering students a variety of online learning resources activities and interactive materials can impact their satisfaction level and attitudes. Finally, it is important to know that there are other factors influencing students' attitudes toward remote learning including their previous online experience, online support services, access to technical support, student-student engagement and collaboration, and appropriate digital curriculum design. In conclusion, this study has attempted to address students' perceptions and attitude toward remote learning in the presence of COVID-19 pandemic. Various factors were used to analyses students' attitude and perceptions using established theories and research. The proposed research questions were evaluated and tested using statistical methods. Future work will involve further investigation in different factors and possible analytical models. In addition, further analysis could be conducted to enhance the current study.

### *1. LIMITATIONS AND FUTURE DIRECTIONS*

Future First, this study uses exploratory data analysis (EDA) to analyze and investigate various factors. In future work, factorial validity using confirmatory factor analysis (CFA) and structure equation modeling (SEM) will be used for model validation. Secondly, this study considered only the TAM model, which has been viewed as a strong predictor of user acceptance and intentions. Additional and competing models are available, including TRA, TPB, and the integrated model, which integrates TAM, innovation diffusion theory, and theory of planned behavior. The comparisons between various models can shed more light on remote learning acceptance and insights. Thirdly, this study focuses on the Omani context, and it is not generalizable to the entire population. Therefore, extending the study to include a regional perspective will further enhance its impact and generalizability. Fourthly, sentiment analysis to analyze students' feedback can provide significant insight and a richer context to understand student experience with remote learning. Considering qualitative data such as student feedback is critical, especially for remote learning. Finally, conducting a longitudinal study for the duration of student study will significantly enhance our understanding of student intention and behavior toward remote learning.

### *2. PRACTICAL IMPLICATIONS AND RECOMMENDATIONS*

The study's findings provide important insights that could be applied in practical settings. Educational institutes should re-think student-teacher engagement when considering remote learning. The importance of engagement in remote learning confirms with existing literature as can be seen in [43]. Offering students a variety of online learning resources activities and interactive materials is important. Considering advance tools to aid interactivity and engagement can help boost student's interaction as indicated in [42]. The ability for students to interact with the materials at their own pace can be incorporated into course designs, making it simpler to adjust to unforeseen situations. Furthermore, promoting cooperation and engagement among peers helps lessen feelings of loneliness and isolation. Schools can also offer faculty training that is especially aimed at fostering student interactivity and engagement through effective course design. By using a range of teaching strategies that prioritize students' accessibility and engagement, educators can make a substantial contribution to the creation of a supportive learning environment. In addition, communication is critical factor in promoting positive attitudes toward the remote learning process. The unwillingness to communicate during remote learning is a factor worth investigating [25]. Another important element to consider is technology accessibility and availability. As seen from our results technology accessibility impact student's perceptions and attitude toward online learning [29, 44]. Making online platforms accessible, easy to use and engaging is a critical success factor. Putting awareness campaigns into action could improve students' understanding and reduce

their fear of online and hybrid learning. In order to maintain students' positive perceptions an attitude toward online learning, the institutions can prioritize improving online learning infrastructure, which include inclusive platforms for all students and reliable internet connectivity.

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## Conflicts of Interest

The authors declare no conflicts of interest.

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